Darling Brothers Limited

MONTREAL - CANADA

ENGINEERS · MANUFACTURERS · FOUNDERS

Since 1888

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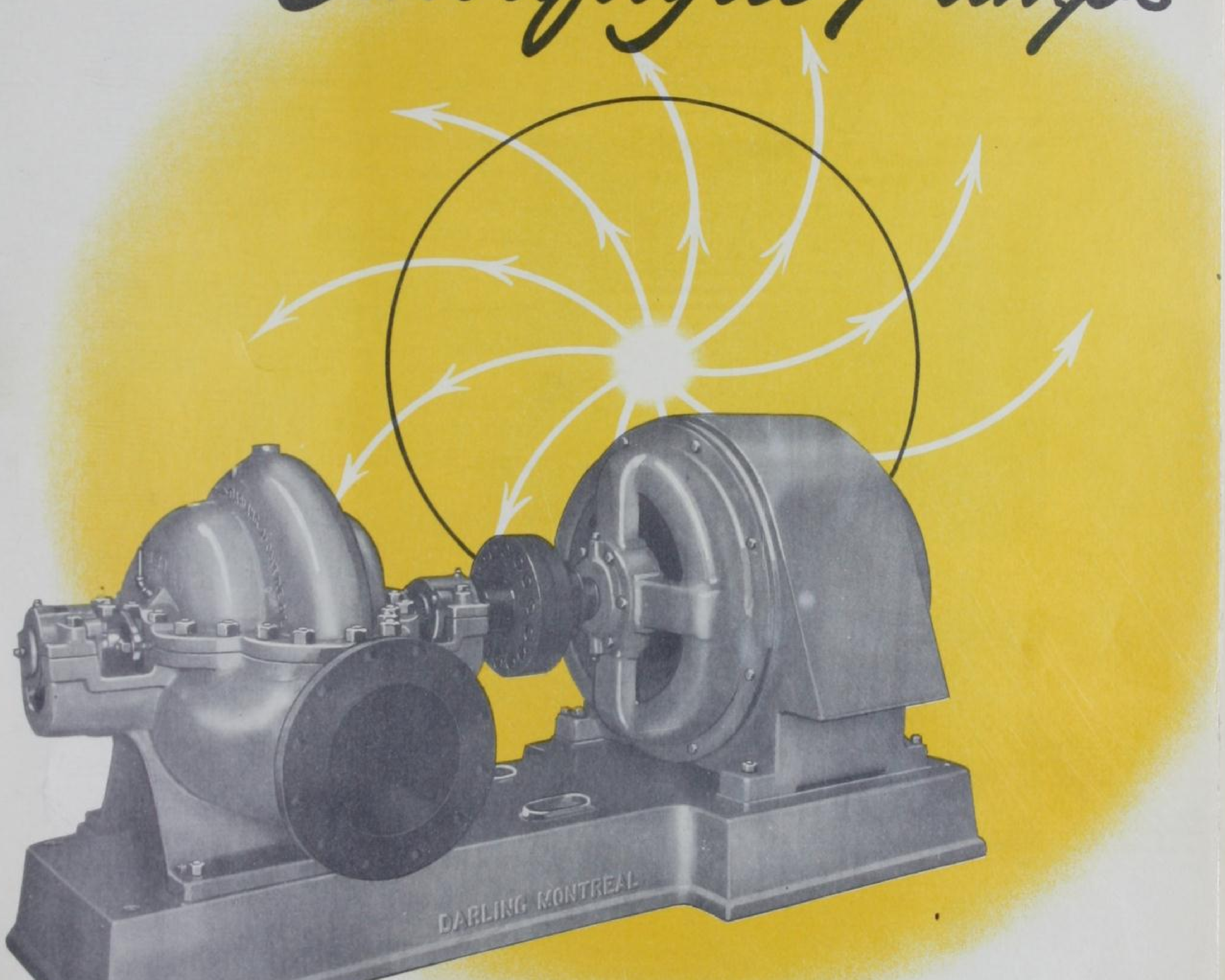
BULLETIN 41-D

DARLING

CLASS "B" *Centrifugal Pumps*



DARLING BROTHERS LIMITED

140 PRINCE ST. MONTREAL, CANADA

HALIFAX • SAINT JOHN • QUEBEC • ARVIDA • TIMMINS
OTTAWA • TORONTO • WINNIPEG • CALGARY • VANCOUVER • ST JOHN'S, NFLD.

Our Guarantee

WE guarantee all pumps made by us against defects in materials and workmanship for one year from date of shipment from our factory. Any part which should prove defective within that period must be returned to our factory all charges fully prepaid. We will then make such part good without any additional compensation.

This guarantee is only effective when equipment has been set up according to our instructions.

Our guarantee does not cover any of our equipment which has been altered or repaired outside of our factory, or motors, electrical appliances or auxiliaries not manufactured by us.

All our pumps are carefully inspected and thoroughly tested before leaving our factory. If they are properly connected and adjusted they will be satisfactory in operation.

All parts are made interchangeable. Duplicate parts are carried in stock and can be shipped promptly.

TESTING DEPARTMENT

The finished Pumps are tested in our Testing Department under working conditions. We have special dynamometers, venturi tubes, tanks, etc., together with all the necessary electrical instruments and power for this purpose. Customers, if interested, are invited to send a representative to witness test of any pump they might order.

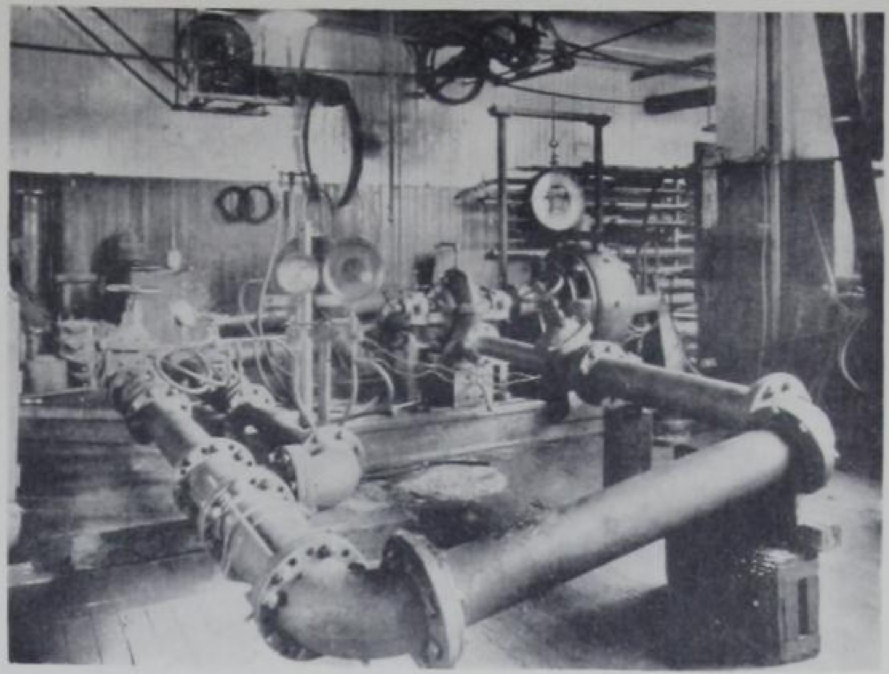


Figure 1.—Dynamometer with Pump on Test.

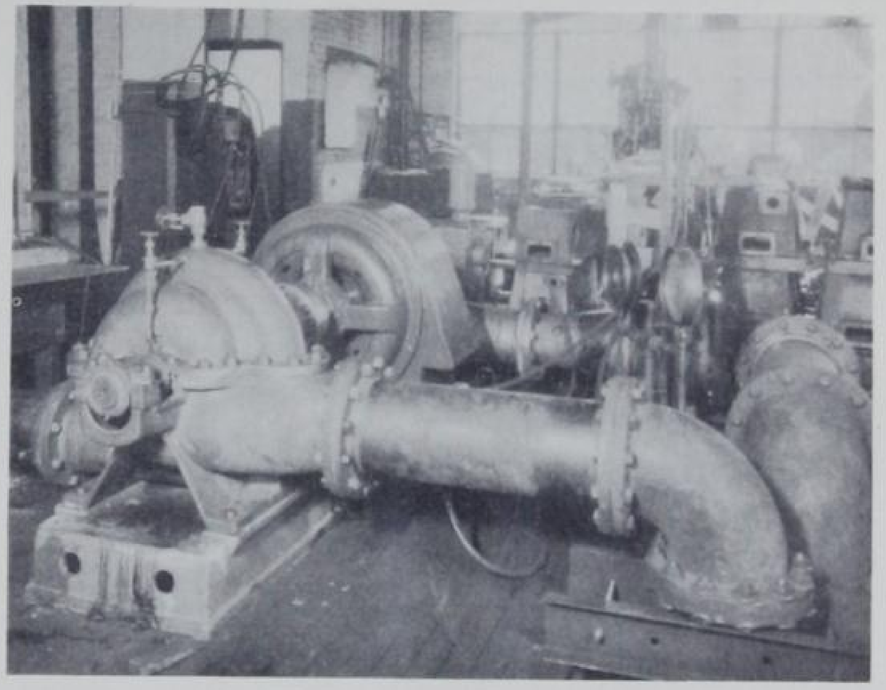


Figure 2.—Direct Connected Motor Driven Pump on Test.

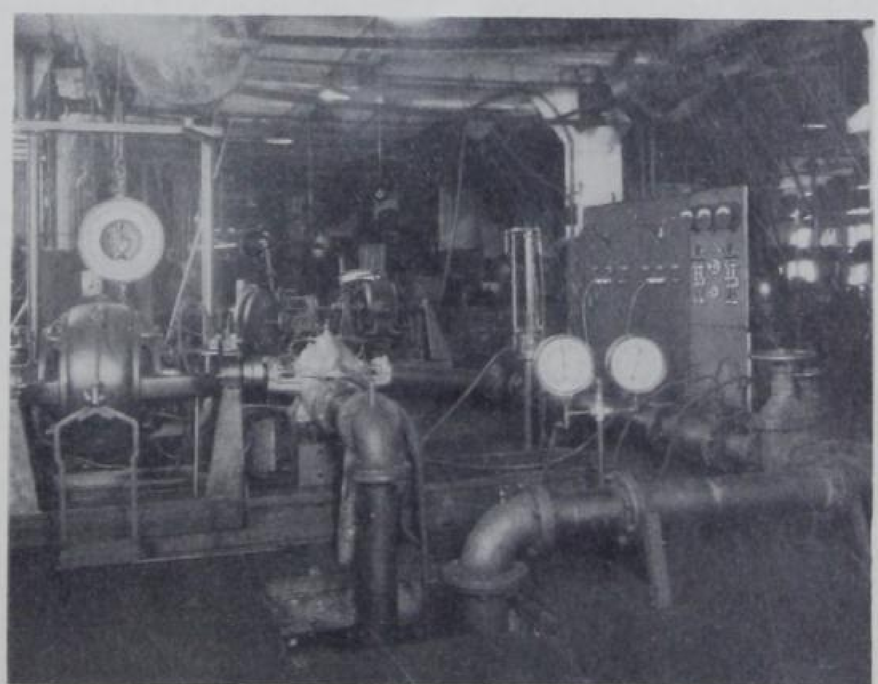


Figure 3.—Dynamometer Test and Control Panel.

General Description

EFFICIENT HORIZONTAL SPLIT CASING—Casing of the double suction volute form, divided horizontally on the centre line, with the flanged suction and discharge nozzles cast integrally with the lower half. The upper half may be easily and quickly removed without disturbing the bearings or pipe connections. The suction nozzles are of the volute type, which give increased efficiency and a smooth and uniformly distributed flow to the impeller eye, and allows pump to operate on high suction lifts. The other water passages in the casing are designed so as to reduce eddy losses to a minimum, and promote efficiency. Several different casing patterns are provided for each size. They are proportioned for a wide range of capacities and heads.

PERMANENT BEARING ALIGNMENT—Bearing brackets are cast as an integral part of the lower half casing. The machining of the casing and bearing seats, being performed in one operation, secure accurate and permanent alignment, a feature impossible to secure where bearing brackets are made as separate castings.

ANTI-FRICTION BEARINGS—Two heavy duty deep groove ball bearings are mounted in cartridge type containers, one at each end of pump. They are secured to the shaft against shoulders, and locked in position by means of SKF nuts and lock washers. Lubricant is sealed in containers by means of felt washers, and the entrance of water is prevented by water-slinger rings. When removing shaft, the containers protect ball bearings against dirt or water.

SLEEVE BEARINGS—When required bronze ring-oiling sleeve bearings can be supplied.

LARGE THRUST BEARINGS—The ball bearing mounted in the outboard container is held against end movement in the container, and is of ample capacity to take care of any end thrust which might occur due to unforeseen operating conditions.

HEAVY WEARING RINGS—Rings are of the semi-circular tongue and groove type. They are held in position by machined recesses in casing, avoiding the use of pins or screws.

DEEP STUFFING BOXES—Stuffing boxes are fitted with a large number of packing rings. When pumps are used with a suction lift, bronze water seal rings, piped up to water under pressure in casing, are supplied. Glands are of bronze, held in position by hinged bolts.

IMPELLER—The accurately balanced impeller is of the non-overloading, double suction, enclosed type. It is cast in bronze in one piece, and has smoothly machined exterior surfaces and smoothly filed water passages.

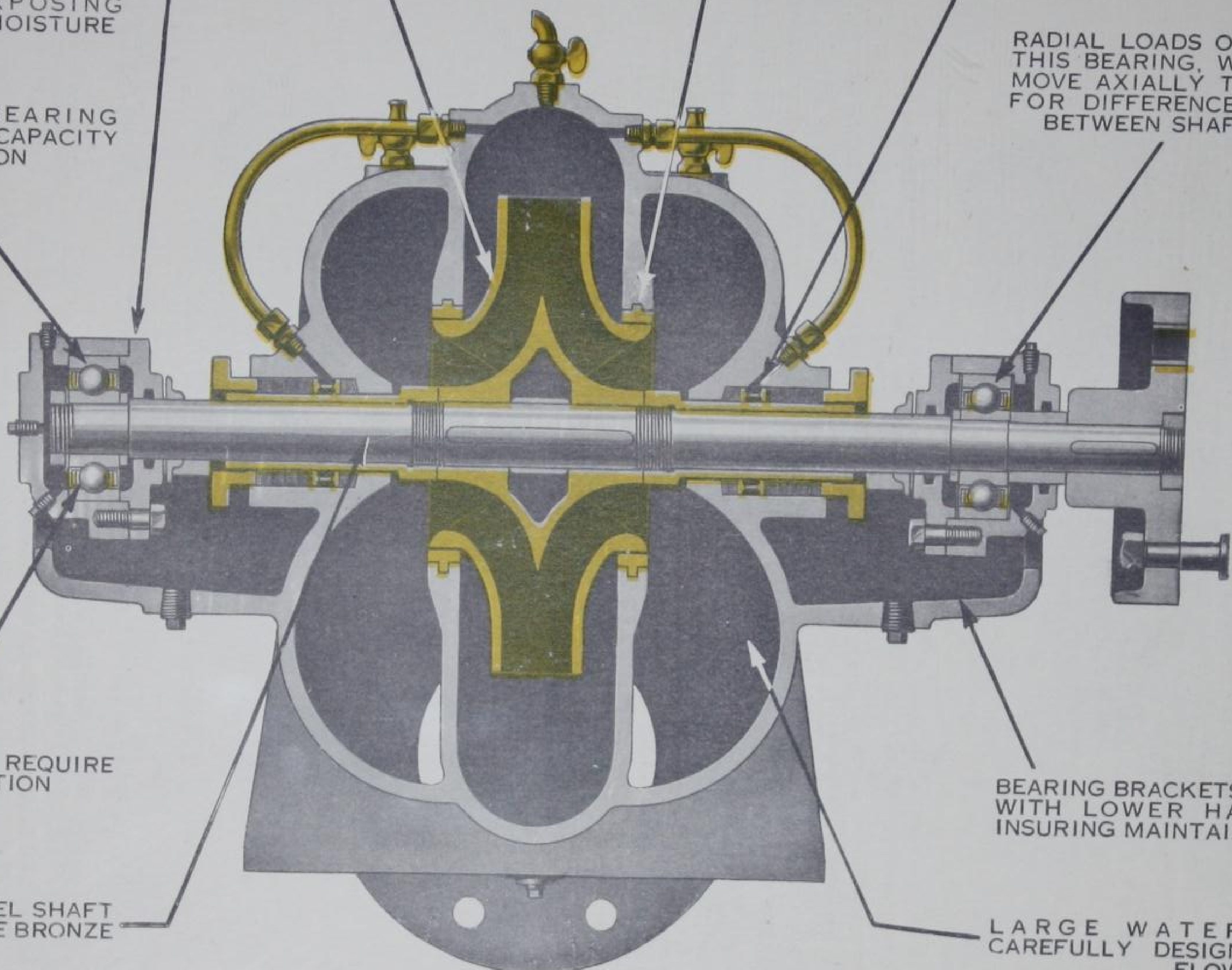
LARGE SHAFT—The shaft is of steel, of high tensile strength and ample size to transmit power. It runs well below its critical speed, so that pump is exceptionally free from vibration.

SHAFT PROTECTING SLEEVES—Bronze, of heavy section secured to shaft by means of right and left hand threads.

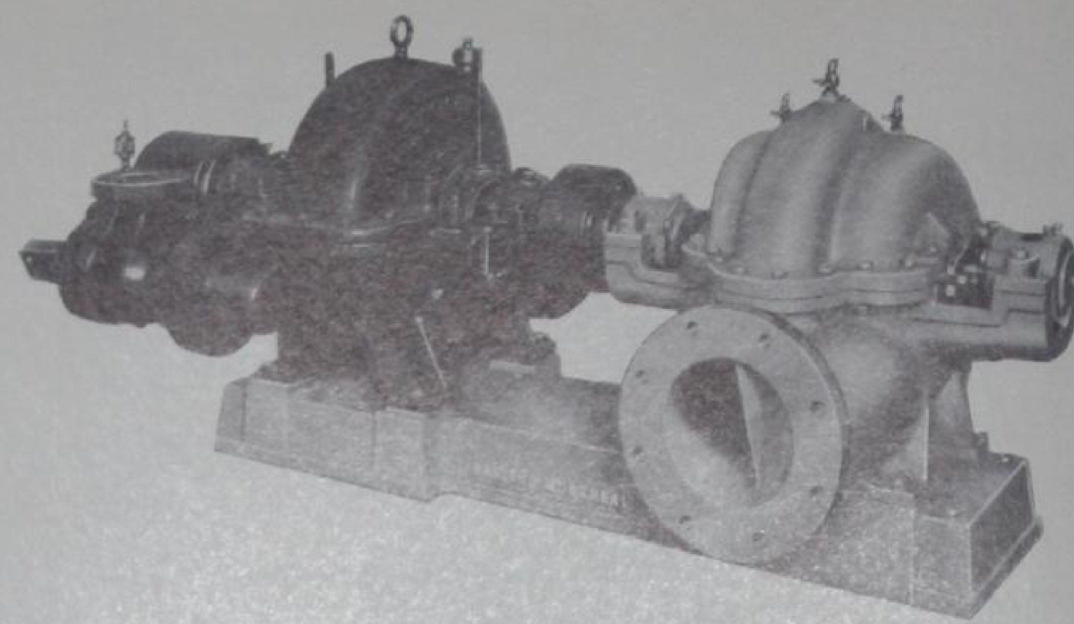
HEAVY BASE—Cast iron, of deep cross section, well ribbed. Foundation bolt holes are located on top of base, obviating danger of breaking lugs. Pump and motive power are mounted and dowelled in place on finished pads to insure accurate reassembling.

COUPLING—To take care of slight misalignment and floating or end play in motive power and pump, a safety flexible coupling is used. This coupling is of the pin and metal lined rubber bush type.

EFFICIENCIES—Higher pump efficiencies and non-overloading impellers, in many cases, permit the use of lower power motors, or prime movers without danger of overloading.

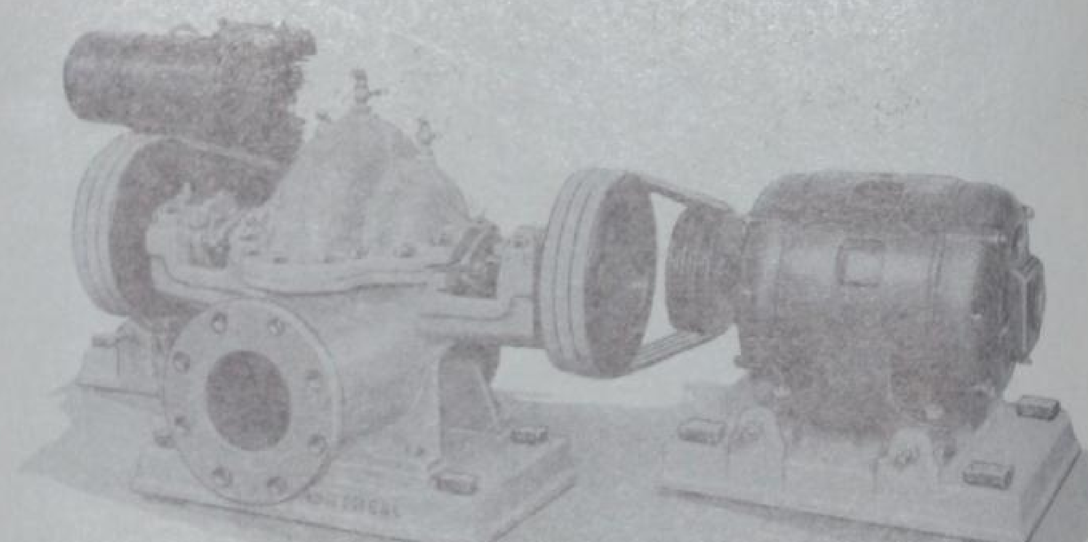


TYPICAL SECTION CLASS "B" CENTRIFUGAL PUMP.



Darling Steam Turbine Driven Class "B" Centrifugal Pump.

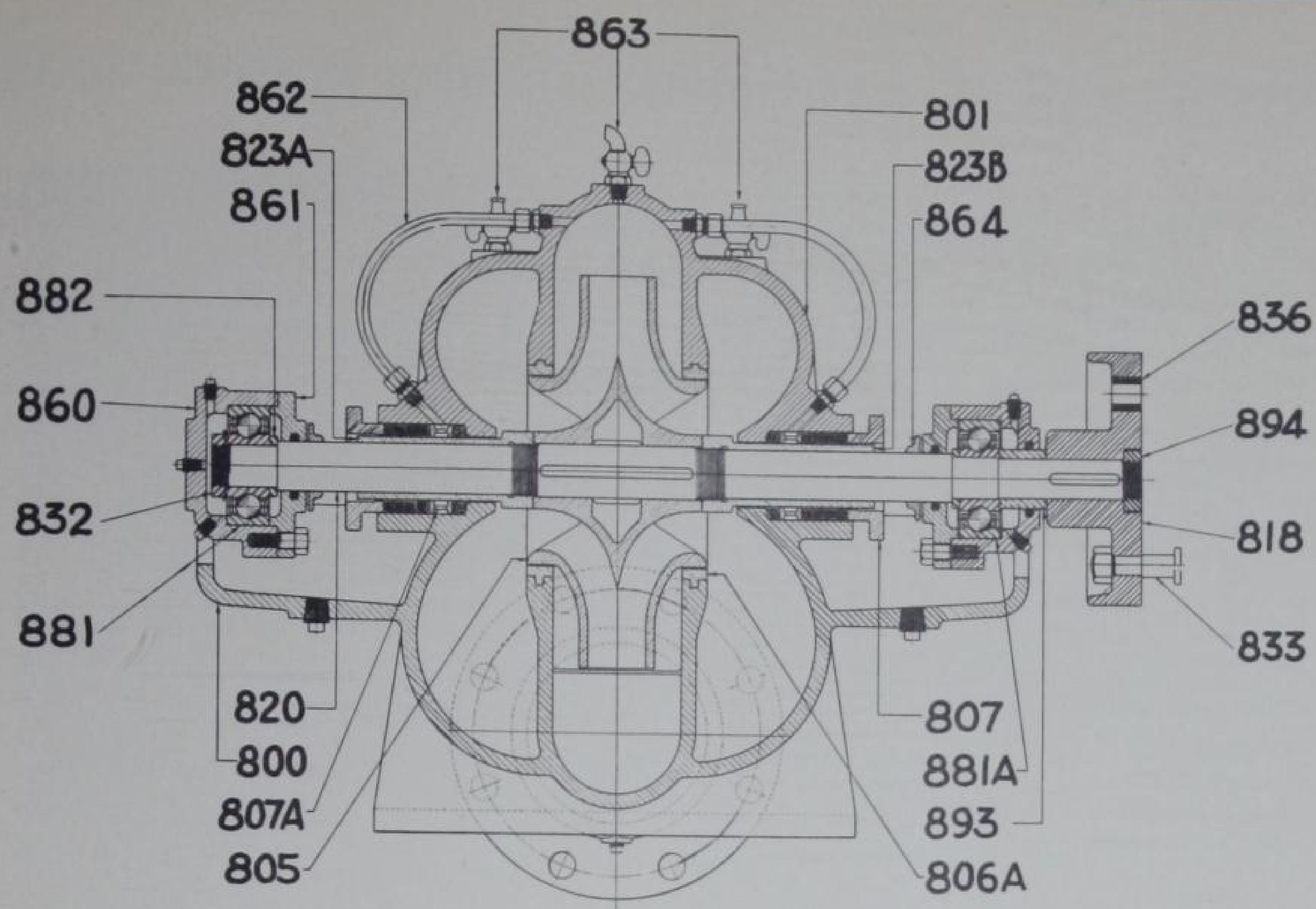
STEAM TURBINE DRIVEN PUMPS.—While Electric Motor driven Pumps are more generally used, Steam Turbine driven Pumps are recommended as a stand-by in case of electric power failure, and also for Power Plants in large Institutions, Public Buildings or Manufacturing Plants, first, in connection with Boiler Feed Pumps, and secondly, where forced hot water heating is installed, the advantage here is readily understood as the exhaust steam from the Turbine is brought directly to the hot water Convertors, resulting in a very economical and quiet method of driving the pump.



Combined Motor and Gasoline Engine Driven Darling Class "B" Pump using V-belt drive.

V-BELT MOTOR DRIVEN PUMPS.—As an alternate to direct connected motor driven Centrifugal Pumps, we suggest, in some cases, a standard V-belt drive. For quiet operation on forced Hot Water Heating Systems, the drive entirely insulates the motor from the pump. Cork pads are supplied as an additional noise prevention. For a change in capacity or head at some future time, after the pump has been installed, the change in the speed of the pump can easily be made by ordering new V-belt pulleys. This type of drive is illustrated above with the added feature of a gasoline engine for emergency use in case of electric failure.

GASOLINE ENGINE DRIVEN PUMPS are suitable as pumping units or as stand-by pumps in Municipal Water Supply Plants. See illustration on page eight.



Typical Sectional view of Single-Stage Centrifugal Pump, standard pattern, horizontally split case type, with individual parts numbered

PART LIST—Class BA, BB, BC, and BH
Horizontal Centrifugal Pumps

800	Bottom Half Casing
801	Top Half Casing
805	Impeller
806A	Case Wearing Ring
807	Gland
807A	Water Seal Ring
818	Coupling
820	Shaft
823A	Shaft Protecting Sleeve
823B	Shaft Protecting Sleeve
832	Locknut for Ball Bearing
833	Pin for Coupling
836	Rubber Bush
860	Ball Bearing Container
861	Ball Bearing Container Cover
862	Water Seal Piping
863	Air Cocks
864	Water Slinger
881	Ball Bearing (Outboard End)
881A	Ball Bearing (Inboard End)
882	Shoulder Ring
893	Spacer Sleeve (Coupling)
894	Coupling Locknut

In ordering repair parts ALWAYS GIVE SERIAL NUMBER OF PUMP, as shown on the name plate

TYPICAL ENGINEER'S SPECIFICATION

Furnish and instal where indicated on plans Darling Class "B" double suction pump, with horizontally split casing, having a capacity of Imp. U.S. G.P.M. when delivering water against a total head of feet, from all causes. Maximum suction lift of feet which is allowed for in total head.

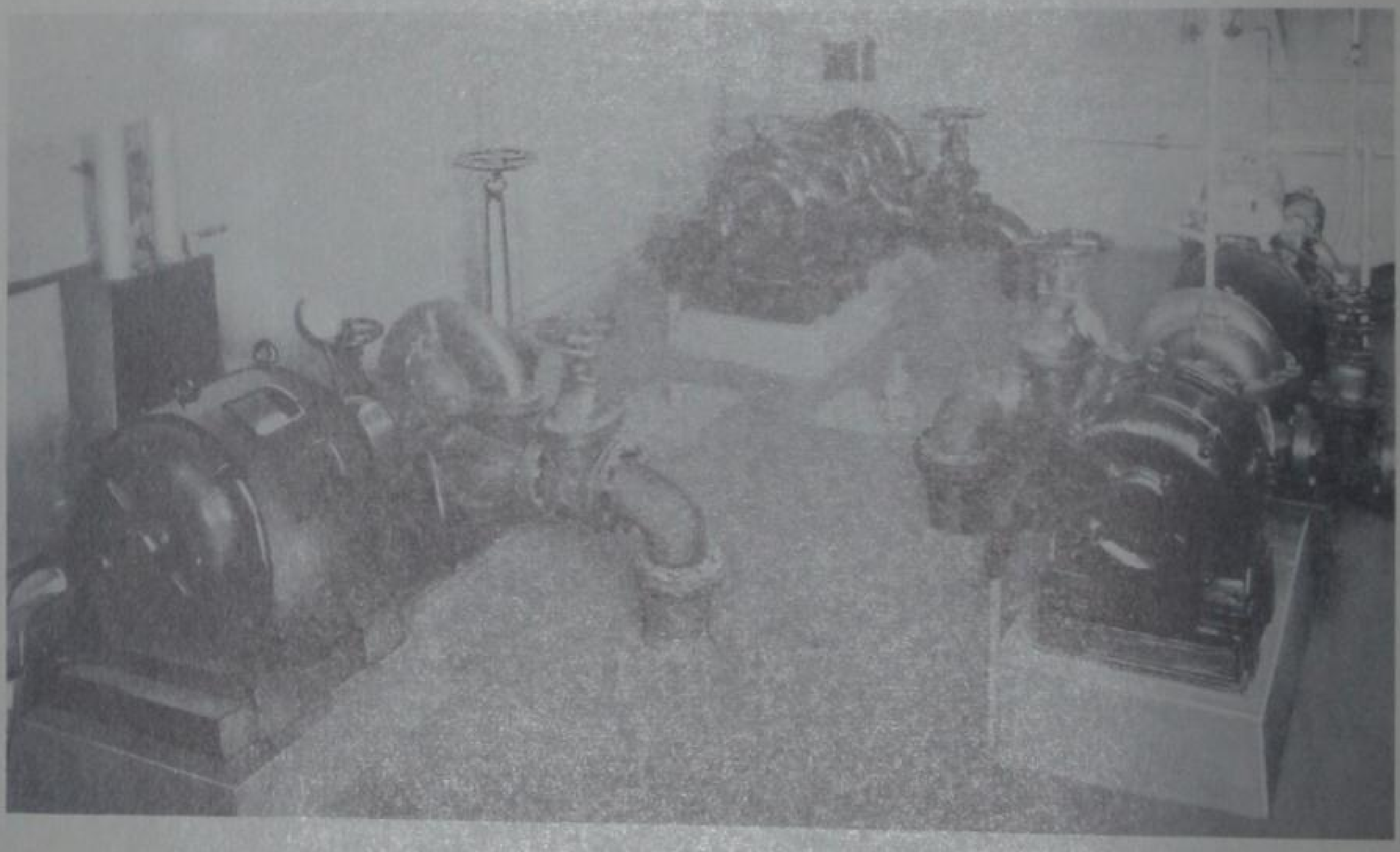
Pump to be driven through flexible coupling by a H.P. phase, cycle, volt, Rev., 40°C. Rise motor.

Motor shall be of ample capacity to perform the above duty without heating, or other indication of overload.

Pump to be equipped with ball bearings, enclosed balanced bronze impeller, and steel shaft with bronze sleeves. Casing to have bronze wearing rings. Pump and motor to be mounted on heavy cast iron base.

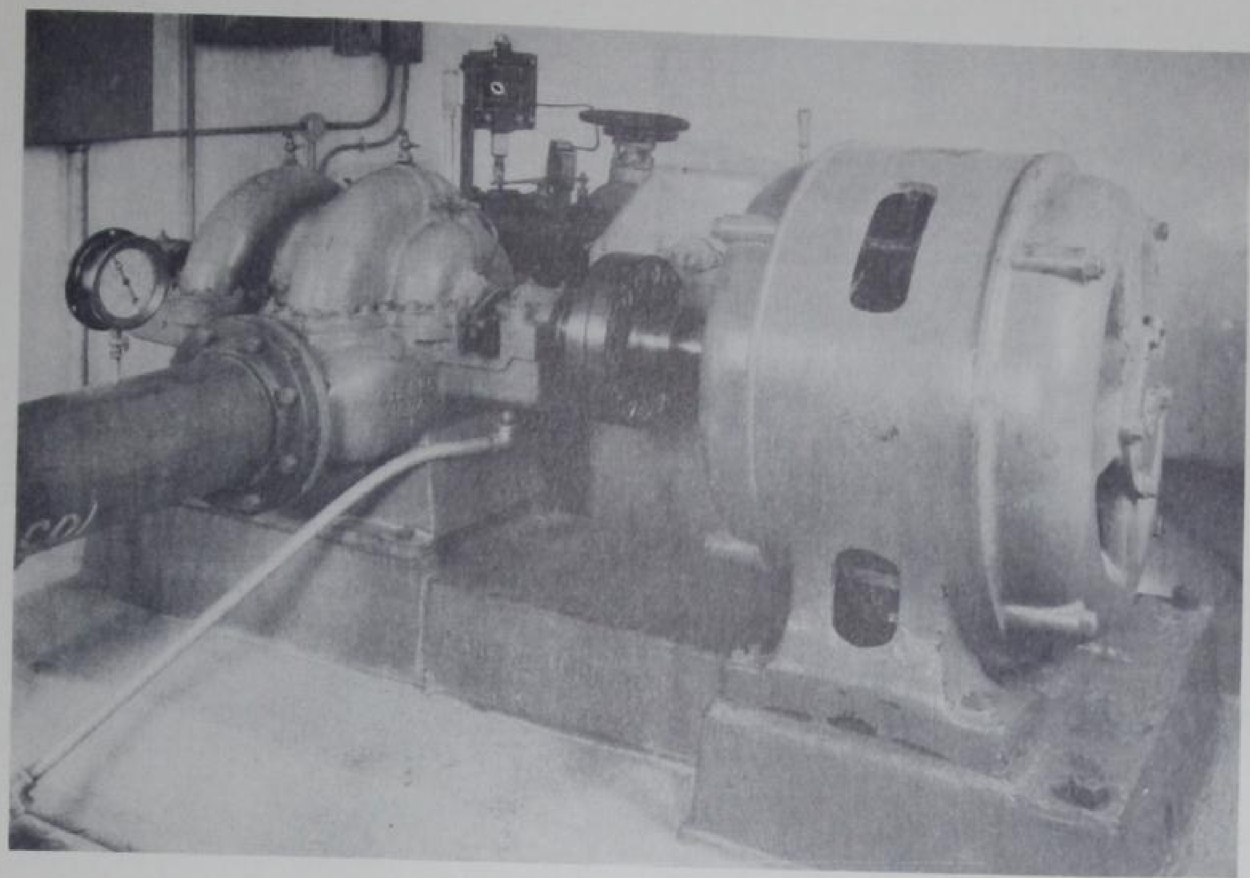
Illustrations of Centrifugal Pump Installations

This illustration shows a combined motor and gasoline engine driven Darling Class "B" Centrifugal Pump installed at the Town of Dorval Water Works, Dorval, P.Q.

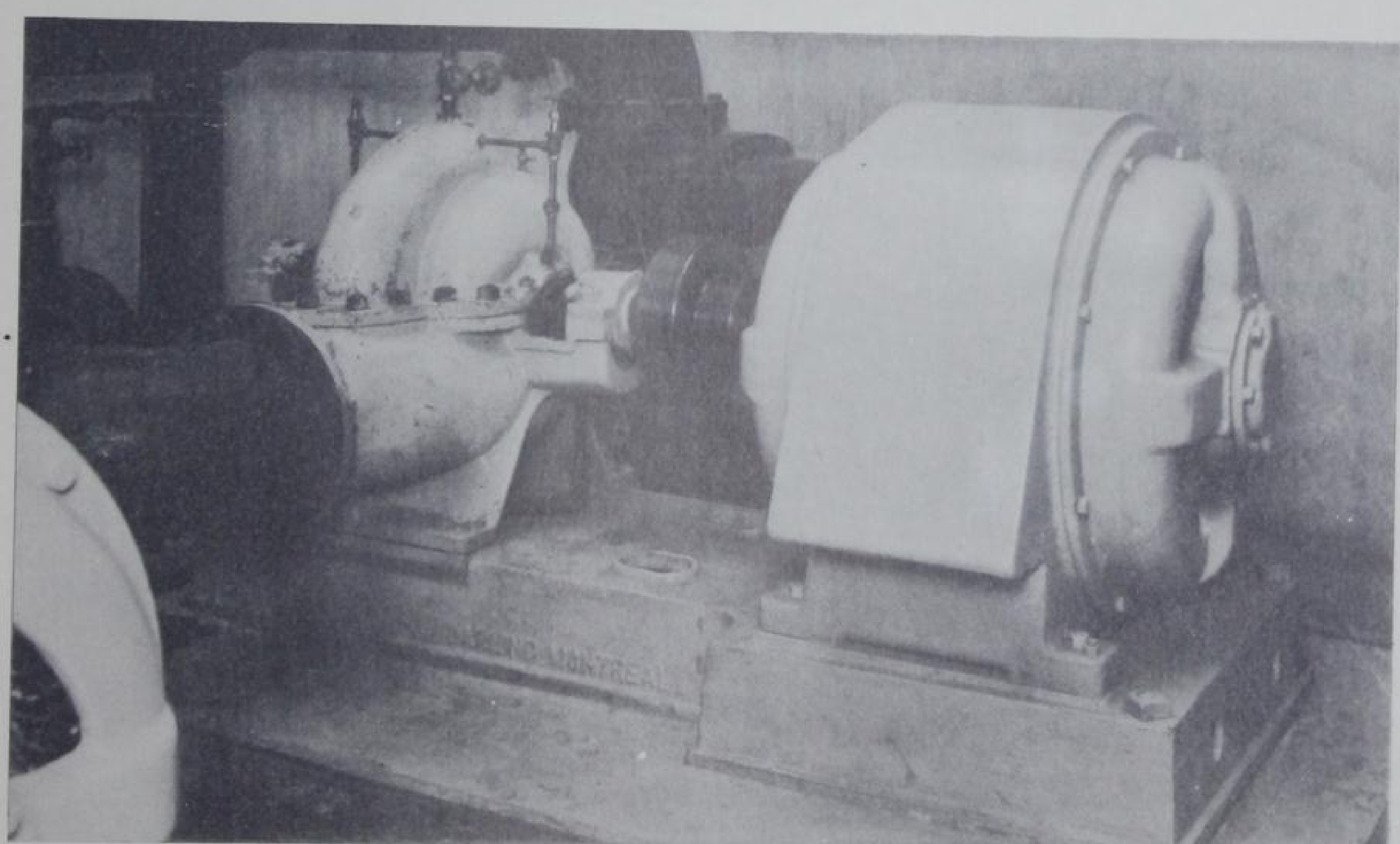


4 Darling Class "B" Centrifugal Pumps at the Town of Dorval Water Works, Dorval, P.Q., are handling the water supply in this modern Water Works and Filtration Plant, also one (1) Darling Vertical Sewage Pump takes care of the Town sewage and surface water. This illustration shows the Pump room and three of the Water Supply Pumps.

Illustrations of Centrifugal Pump Installations

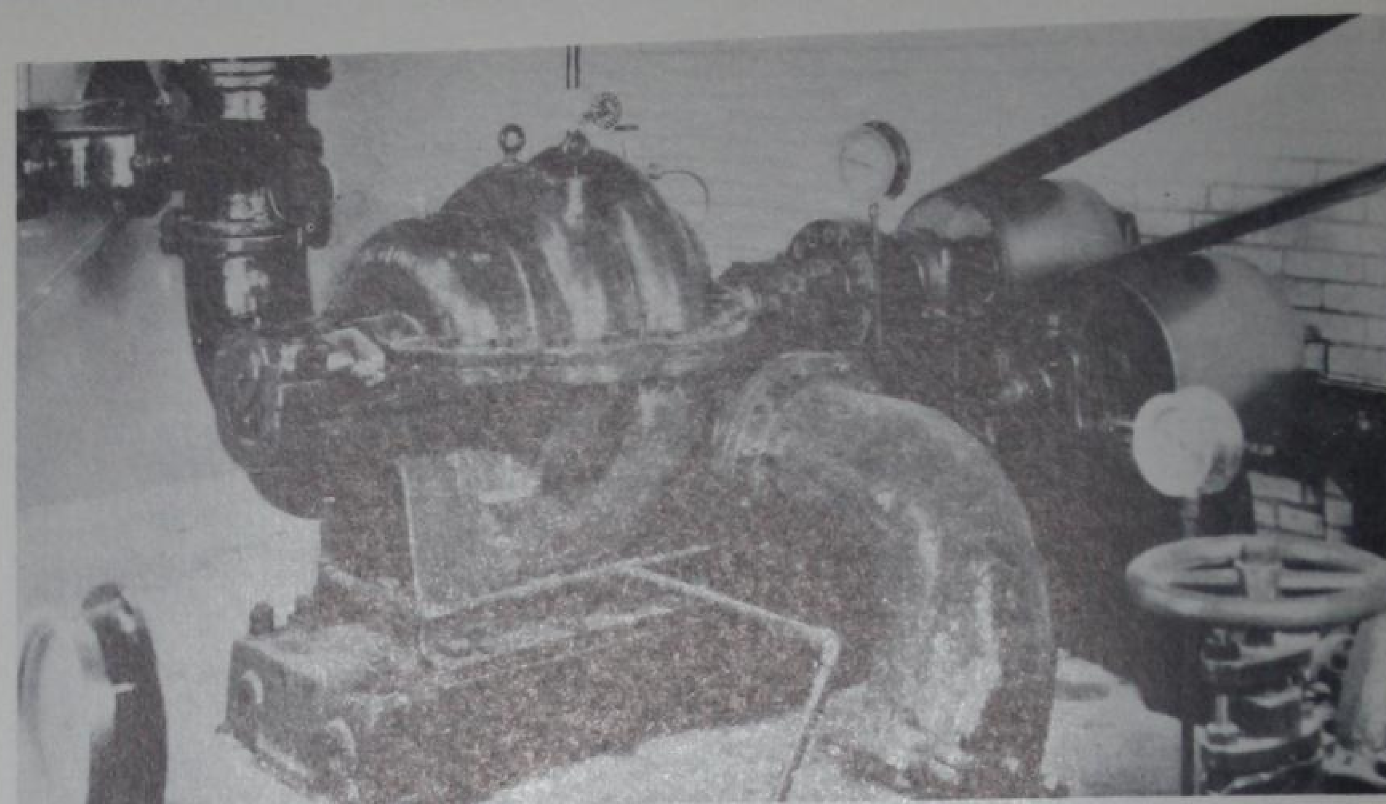


6″ x 8″ Darling motor driven Class "BBS" 2-stage Centrifugal Pump, operating under automatic control. Capacity 1000 Imperial gallons per minute against 300 ft., head, supplied to the City of Vernon, Vernon, B.C., for water supply purposes.

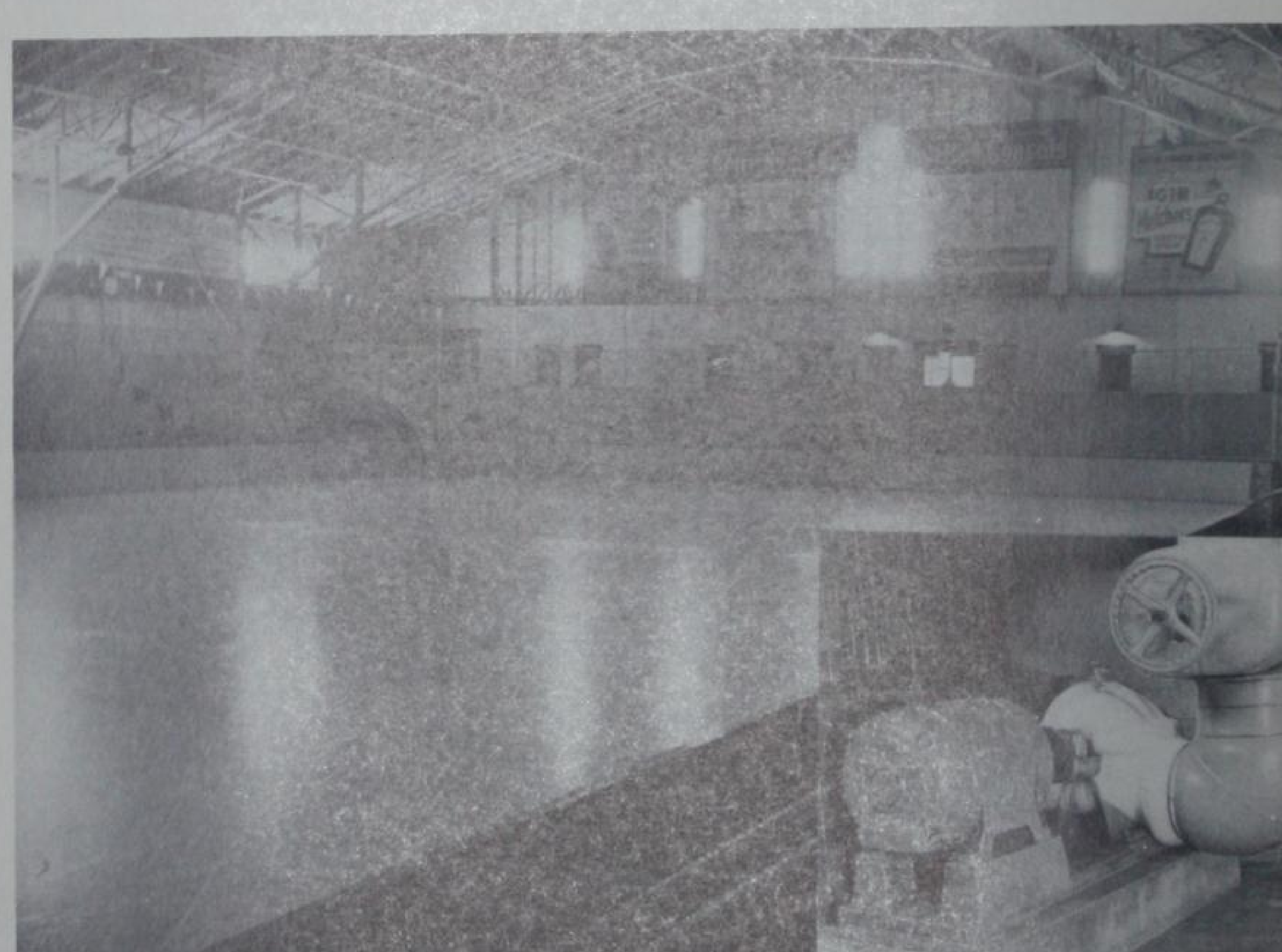


3 Darling Class "B" Centrifugal Pumps supply water from the St. Lawrence River for process work at the McColl-Frontenac Oil Refinery, situated at Montreal East, near the City of Montreal. The combined capacity of these pumps is 4200 G.P.M. against 236 ft., total head. This illustration shows 1—8″ x 10″ Class "B" Darling Centrifugal Pump, driven by 175 H.P. motor, capacity 2200 gallons per minute.

Illustrations of Centrifugal Pump Installations



8″ x 10″ Darling Centrifugal Pump with belt-drive, capacity 2000 gallons per minute against 65 pounds pressure, installed at Water Works, in the City of Valleyfield.



6″ x 6″ Darling motor driven Class "B" Centrifugal Pump for brine circulation. Capacity 800 gallons per minute against 50 ft., head, installed in Artificial Ice Arena, Lachine, Que.

INSTRUCTIONS

for the Care and Operation of Darling Class "B" Centrifugal Pumps

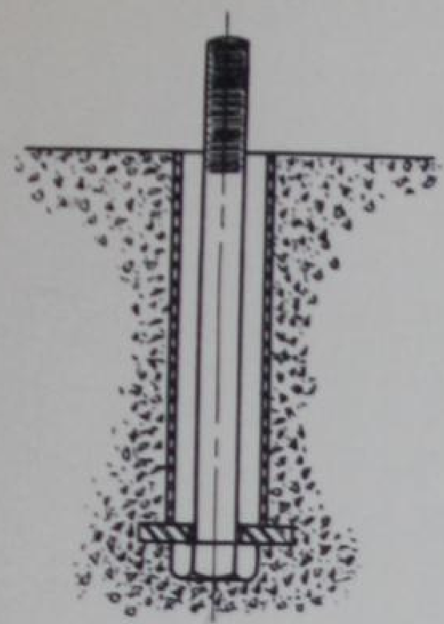


Fig. 1

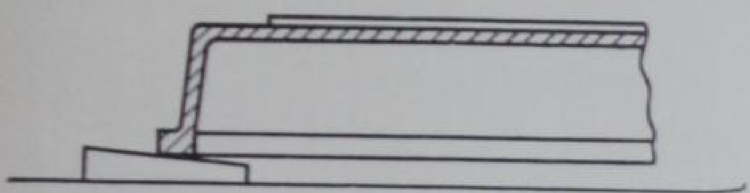


Fig. 2

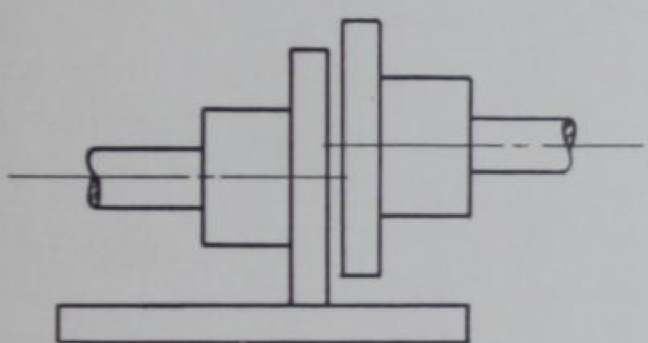


Fig. 3
(Shown out of line)

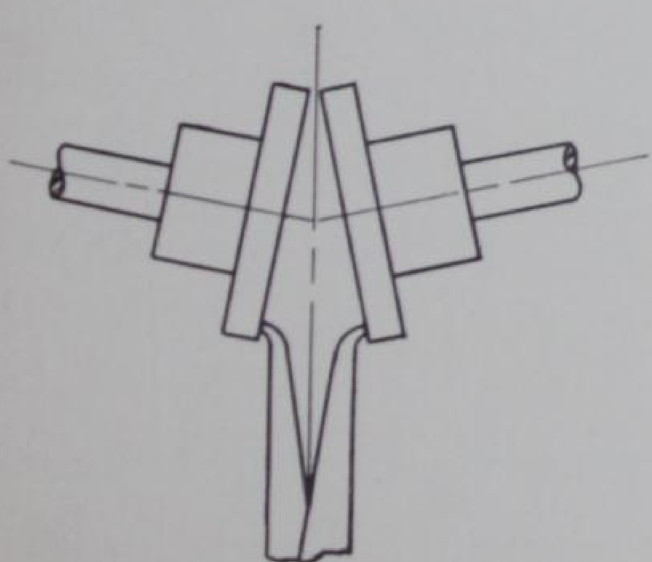


Fig. 4
(Shown out of line)

General:

Every pump is carefully tested before shipment. It will deliver rated capacity and head at rated speed, and is in perfect working order when shipped.

Foundation:

Pump must have a good foundation, preferably concrete. Locate foundation bolts to drawing or template and arrange as shown in Fig. 1. Use pipe sleeve about two and one half diameters larger than the bolt.

Alignment:

Pump and motor must be set level and properly lined up. A flexible coupling will not compensate for misalignment. Every baseplate is elastic, no matter how heavy it is, and will spring to a certain extent. It can be readily brought back to its original shape by the use of wedges and foundation bolts as described below.

Wedge the base up about ¾" above top of foundation; this leaves space for grouting (Fig. 2). Adjust wedges and level base from machined pads on which pump and motor are mounted.

Check alignment at the coupling. A straight edge across coupling must rest evenly on both rims at top, bottom and sides (Fig. 3).

With a pair of inside calipers or a thickness gauge, check the distance between coupling halves at the points at which the straight edge was used (Fig. 4). Distances should be equal.

If any adjustments are required these can be made by means of the wedges and foundation bolts.

If the pump is connected to driver by V-belt, check the alignment by the use of a straight edge across the sides of the pulleys.

When the pump is driven by a steam turbine or handling hot water, the whole unit should be lined up, after it has been brought up to temperature.

Grouting:

For grouting build a dam around baseplate at least 2½" high and fill with cement grout. After cement has hardened tighten anchor bolts and recheck alignment. Any misalignment apparent now must be corrected by placing shims under feet of driver or pump.

Piping:

Piping should be arranged with as few bends as possible, and these should preferably be made with long radius. Piping to discharge and suction flanges of pump should fit exactly, and under no conditions should piping exert strain on the pump, as this will throw the unit out of alignment or distort the casing.

Suction lines must be kept absolutely free from air leaks. It is advisable to place a check valve as well as a gate valve in the discharge line close to the pump. On pumps with a flooded suction, gate valves should be installed close to pump in both suction and discharge lines.

It is preferable to have a short length of pipe, two or four diameters long, attached to the suction of the pump.

On installations with suction lift it is advisable to install a foot valve for priming purposes. A positive head on suction is required when handling water above 160°F.

Stuffing Boxes and Packing:

The packing should not be made too tight as this may result in the burning of the packing and cutting of the shaft. The packing should be loose enough to allow a slight leakage of liquid through the gland.

Draining:

A drain pipe should be connected to the drain in the pump base. To prevent the pump from freezing in cold weather, the casing should be drained.

Starting:

Do not start the pump until it has been primed. The clearances between impeller and casing are very small and they will bind or cut if the pump is run without water. Make sure that the driver rotates in the same direction as the arrow on the pump casing.

Grease Lubrication:

The factory packs these bearings with an amount of grease which ordinarily will suffice for a period of six to twelve months depending upon observable leakage and the severity of the service. As often as the above considerations render necessary, bearings should be cleaned and repacked approximately one-half full with grease.

CAPACITY TABLES – Class "B" Pumps

HEAD IN FEET	SPEED	U.S. GALLONS PER MINUTE 50	75	100	125	150	175	200	225	250	300
20	1150 1750	1½"BBBD¾ 1½"BBBD¾	2"BBBD¾ 2"BBBD1	2"BBBD1 2"BBBD1	2"BBBD1 2"BBBD1½	3"BBBD1½ 3"BBBD1½	3"BBBD1½ 3"BBBD2	3"BBBD1½ 3"BBBD2	3"BBBD1½ 3"BBD2	3"BBBD2 3"BBBD2	4"BBBD3 3"BBBD3
30	1150 1750	1½"BBBD1 1½"BBBD1	2"BBBD1 1½"BBBD1½	2"BBBD1½ 2"BBBD1½	2"BBBD2 2"BBBD2	3"BBBD2 3"BBBD2	3"BBBD2 3"BBBD3	3"BBBD2 3"BBBD3	3"BBBD3 3"BBBD3	3"BBBD3 3"BBBD3	4"BBBD3 3"BBBD5
40	1150 1750	1½"BBFD1½ 1½"BBBD1½	2"BBBD1½ 1½"BBBD1½	2"BBBD2 2"BBBD2	2"BBED3 2"BBBD2	3"BBED3 2"BBBD3	3"BBED3 3"BBBD3	3"BBED5 3"BBBD5	3"BBED5 3"BBBD5	3"BBED5 3"BBBD5	4"BBBD5 3"BBBD5
50	1150 1750	1½"BBFD2 1½"BBBD1½	2"BBED2 1½"BBBD2	2"BBED3 2"BBBD3	2"BBED3 2"BBBD3	3"BBED5 2"BBBD3	3"BBED5 2"BBBD5	3"BBED5 3"BBBD5	3"BBED5 3"BBBD5	3"BBED7½ 3"BBBD5	3"BBED7½ 3"BBBD5
60	1150 1750	1½"BBFD2 1½"BBBD2	2"BBED3 1½"BBBD3	2"BBED5 2"BBBD3	2"BBED5 2"BBBD3	2"BBED5 2"BBBD5	3"BBED5 2"BBBD5	3"BBED7½ 2"BBBD7½	3"BBED7½ 3"BBBD7½	3"BBED7½ 3"BBBD7½	3"BHQD7½ 3"BBBD7½
70	1150 1750	1½"BBFD2 1½"BBBD2	2"BBED3 1½"BBBD3	2"BBED5 2"BBBD3	2"BBED5 2"BBBD5	2"BBED5 2"BBBD5	3"BBED7½ 2"BBBD5	3"BHQD7½ 2"BBBD7½	3"BHQD7½ 3"BBBD7½	3"BHQD7½ 3"BBBD7½	3"BHQD10 3"BBBD7½
80	1150 1750	1½"BBFD3 1½"BBBD3	2"BBED3 1½"BBFD5	2"BBED5 2"BBBD5	3"BHQD7½ 2"BBBD5	3"BHQD7½ 2"BBBD5	3"BHQD7½ 2"BBED7½	3"BHQD7½ 2"BBED7½	3"BHQD7½ 3"BBED7½	3"BHQD7½ 3"BBED7½	3"BHQD10 3"BBED10
90	1150 1750	1½"BBFD3	1½"BBFD5	2"BBED5	3"BHQD7½ 2"BBBD5	3"BHQD7½ 2"BBED7½	3"BHQD7½ 2"BBED7½	3"BHQD10 2"BBED7½	3"BHQD10 3"BBED10	3"BHQD10 3"BBED10	3"BHQD10 3"BBED10
100	1150 1750	1½"BBFD5	1½"BBFD5	2"BBED5	3"BHQD7½ 2"BBED7½	3"BHQD7½ 2"BBED7½	3"BHQD10 2"BBED7½	3"BHQD10 2"BBED10	3"BHQD10 3"BBED10	3"BHQD10 3"BBED10	3"BHQD15 3"BBED15
120	1150 1750	1½"BBFD5	1½"BBFD5	1½"BBFD7½	3"BHQD10 2"BBED7½	3"BHQD10 2"BBED7½	3"BHQD15 2"BBED10	3"BHQD15 2"BBED10	3"BHQD15 3"BBED15	3"BHQD15 3"BBED15	3"BHQD15 3"BBED15
140	1750	1½"BBFD5	1½"BBFD7½	1½"BBFD7½	2"BBED10	2"BBED10	2"BBED15	2"BBED15	2"BBED15	3"BBED15	3"BBED20
160	1750	1½"BFBD5	1½"BBFD7½	1½"BBFD10	2"BBED10	2"BBED15	2"BBED15	2"BBED15	2"BBED20	3"BBED20	3"BBED20
180	1750				2"BBED15	2"BBED15	3"BHQD20	3"BHQD20	3"BHQD20	3"BHQD25	3"BHQD25
200	1750				3"BHQD20	3"BHQD20	3"BHQD20	3"BHQD20	3"BHQD20	3"BHQD25	3"BHQD25
220	1750				3"BHQD20	3"BHQD20	3"BHQD25	3"BHQD25	3"BHQD30	3"BHQD30	3"BHQD30
260	1750				3"BHQD25	3"BHQD30	3"BHQD30	3"BHQD30	3"BHQD40	3"BHQD40	3"BHQD40
Pipe Friction Feet Head Per 100 Feet Run		1½" 28.5' 2" 8.46' 3" 1.24' 4" .33'	1½" 60.4' 2" 17.9' 3" 2.62' 4" .71'	1½" 103' 2" 30.5' 3" 4.47' 4" 1.19'	2" 46.2' 3" 6.78' 4" 1.81' 5" .61'	2" 64.7' 3" 9.48' 4" 2.53' 5" .85'	2" 83.9' 3" 12.8' 4" 3.36' 5" 1.11'	2" 110' 3" 16.1' 4" 4.29' 5" 1.43'	2" 134' 3" 20.1' 4" 5.38' 5" 1.78'	3" 24.5' 4" 6.51' 5" 2.17' 6" .88'	3" 34.1' 4" 9.09' 5" 3.03' 6" 1.24'

Note: Dimensions of these pumps and motors available on request either from dimension prints or in ready-templates.

HEAD IN FEET	SPEED	U.S. GALLONS PER MINUTE 400	500	600	700	800	1000	1250	1500	1750	2000
20	1150 1750	4″BBBD5 4″BBBD3	5″BHBD5 4″BBBD5	5″BHBD5	6″BMND7½	6″BMND7½	8″BMKD7½				
30	1150 1750	4″BBBD5 4″BBBD5	5″BHBD7½ 4″BBBD5	5″BHBD7½ 4″BBBD7½	6″BMND7½ 5″BHBD10	6″BMND10 5″BHBD10	6″BMND10	8″BMKD15	8″BMKD15	8″BMKD20	10″BMKD20
40	1150 1750	4″BHED7½ 3″BBBD7½	4″BHED7½ 4″BBBD7½	5″BHED7½ 4″BBBD10	6″BMND10 5″BHBD10	6″BMND10 5″BHBD10	6″BMND15 5″BHBD15	6″BMND20 6″BMND20	8″BMKD25	8″BMKD25	10″BMKD25
50	1150 1750	4″BHED7½ 3″BBBD7½	4″BHED10 4″BBBD10	5″BHED10 4″BBBD15	6″BMND15 5″BHBD15	6″BMND15 5″BHBD15	6″BMND20 5″BHBD20	8″BMKD20 6″BMND25	8″BMKD25 6″BMND25	8″BMKD30 8″BMKD30	8″BNUD40
60	1150 1750	4″BHED10 3″BBBD7½	4″BHPD15 4″BBBD15	5″BHED15 4″BBBD15	5″BHED15 5″BHBD15	5″BHED15 5″BHBD15	6″BCRD20 5″BHBD20	8″BMKD25 6″BMND25	8″BMKD30 6″BMND30	8″BMKD40 8″BMKD40	8″BNUD40 8″BMKD50
70	1150 1750	4″BHPD15 3″BBBD10	4″BHPD15 4″BBBD15	4″BHPD20 4″BBBD15	5″BMND20 5″BHBD20	5″BMND20 5″BHBD20	6″BCRD25 5″BHED25	8″BMKD30 6″BMND30	8″BNUD40 6″BMND40	8″BNUD40 8″BMKD40	8″BNUD50 8″BMKD50
80	1150 1750	4″BHPD15 3″BBED15	4″BHPD15 4″BBBD15	4″BHPD20 4″BBBD20	5″BMND20 5″BHBD20	5″BMTD25 5″BHBD20	6″BCRD30 5″BHED30	6″BCRD30 6″BMND40	6″BCRD40 6″BMND40	8″BNUD50 8″BMKD50	8″BNUD60 8″BMKD75
90	1150 1750	4″BHPD15 3″BBED15	4″BHPD20 4″BHED15	4″BHPD20 4″BHED20	5″BMND20 4″BHED25	5″BMTD25 5″BHED25	6″BCRD30 5″BHED30	6″BCRD40 6″BMND40	6″BCRD40 6″BMND50	8″BNUD50 8″BMKD60	8″BNUD60 8″BMKD75
100	1150 1750	4″BHPD15 3″BBED15	4″BHPD20 4″BHED20	5″BMTD20 4″BHED20	5″BMTD25 4″BHED25	5″BMTD30 5″BHED30	6″BCRD40 5″BHED40	6″BCRD40 6″BMND40	6″BCRD50 6″BMND50	8″BNUD60 8″BMKD60	8″BNUD75 8″BMKD75
120	1150 1750	4″BHPD20 3″BBED20	5″BMTD20 4″BHED20	5″BMTD25 4″BHED25	5″BMTD30 4″BHED30	5″BMTD40 5″BHED40	5″BMTD40 5″BHED40	6″BCRD50 6″BMND50	8″BNUD75 6″BMND60	8″BNUD75 8″BMKD75	8″BNUD100 8″BMKD100
140	1750	3″BBED20	4″BHED25	4″BHED30	4″BHED40	5″BHED40	5″BMND50	6″BMND60	6″BMND75	8″BMKD100	8″BMKD100
160	1750	3″BHQD25	4″BHED30	4″BHED40	4″BHED40	5″BHED50	5″BMND60	5″BMTD75	6″BMND100	8″BNUD100	8″BNUD125
180	1750	3″BHQD30	4″BHPD40	4″BHPD40	4″BHPD50	5″BMND50	5″BMND60	5″BMTD75	6″BCRD100	8″BNUD125	8″BNUD150
200	1750	3″BHQD30	4″BHPD40	4″BHPD50	4″BHPD50	5″BMND60	5″BMND75	5″BMTD100	6″BCRD100	8″BNUD150	8″BNUD150
220	1750	3″BHQD40	4″BHPD50	4″BHPD50	4″BHPD60	5″BMND60	5″BMND75	5″BMTD100	6″BCRD125	6″BCRD150	8″BNUD150
260	1750	3″BHQD50	4″BHPD60	4″BHPD60	5″BMTD75	5″BMTD75	5″BMTD100	5″BMTD125	6″BCRD125	6″BCRD150	8″BNUD175
Pipe Friction Feet Head Per 100 Feet Run		3″ 58′	4″ 23.4′	4″ 32.8′	4″ 43.6′	5″ 18.6′	5″ 28.1′	5″ 44.6′	6″ 24.3′	6″ 32.4′	8″ 10.9′
		4″ 15.5′	5″ 7.79′	5″ 10.9′	5″ 14.5′	6″ 7.6′	6″ 11.5′	6″ 17.3′	8″ 6.39′	8″ 8.48′	10″ 3.6″
		5″ 5.15′	6″ 3.19′	6″ 4.46′	6″ 5.93′	8″ 2′	8″ 3.02′	8″ 4.58′	10″ 2.11′	10″ 2.82′	12″ 1.5′
		6″ 2.11′	8″ .84′	8″ 1.17′	8″ 1.56′	10″ .66′	10″ 1.0′	10″ 1.52′	12″ .89′	12″ 1.19′	14″ .93′

THEORETICAL DISCHARGE OF NOZZLES IN U.S. GALLONS PER MINUTE

Head		Velocity of Disch. Ft. Sec.	DIAMETER OF NOZZLES IN INCHES																			
lbs.	feet		1/16	1/8	3/16	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3
10	23.1	38.6	0.37	1.48	3.32	5.91	13.3	23.6	36.9	53.1	72.4	94.5	120	148	179	213	289	378	479	591	714	851
15	34.6	47.25	0.45	1.81	4.06	7.24	16.3	28.9	45.2	65.0	88.5	116.	147	181	219	260	354	463	585	723	874	1041
20	46.2	54.55	0.52	2.09	4.69	8.35	19.8	33.4	52.2	75.1	102.	134.	169	209	253	301	409	535	676	835	1009	1203
25	57.7	61.0	0.58	2.34	5.25	9.34	21.0	37.3	58.3	84.0	114.	149.	189	234	283	336	458	598	756	934	1128	1345
30	69.3	66.85	0.64	2.56	5.75	10.2	23.0	40.9	63.9	92.0	125.	164.	207	256	309	368	501	655	828	1023	1236	1473
35	80.8	72.2	0.69	2.77	6.21	11.1	24.8	44.2	69.0	99.5	135.	177.	224	277	334	398	541	708	895	1106	1335	1591
40	92.4	77.2	0.74	2.96	6.64	11.8	26.6	47.3	73.8	106.	145.	188.9	239	296	357	425	578	756	957	1182	1428	1701
45	103.9	81.8	0.78	3.13	7.03	12.5	28.2	50.1	78.2	113.	153.	200.	253	313	379	451	613	801	1015	1252	1512	1802
50	115.5	86.25	0.83	3.30	7.41	13.2	29.7	52.8	82.5	119.	162.	211.	267	330	399	475	647	845	1070	1320	1595	1900
55	127.0	90.5	0.87	3.46	7.77	13.8	31.1	55.3	86.4	125.	169.	221.	280	346	418	498	678	886	1121	1385	1671	1991
60	138.6	94.5	0.90	3.62	8.12	14.5	32.5	57.8	90.4	130.	177.	231.	293	362	438	521	708	926	1172	1447	1748	2085
65	150.1	98.3	0.94	3.77	8.45	15.1	33.8	60.2	94.0	135.	184.	241.	305	376	455	542	737	964	1220	1506	1819	2165
70	161.7	102.1	0.98	3.91	8.78	15.7	35.2	62.5	97.7	141.	191.	250.	317	391	473	563	765	1001	1267	1565	1888	2250
75	173.2	105.7	1.01	4.05	9.08	16.2	36.4	64.7	101.	146.	198.	259.	327	404	489	582	792	1037	1310	1619	1955	2330
80	184.8	109.1	1.05	4.18	9.39	16.7	37.6	66.8	104	150.	205.	267.	338	418	505	602	818	1070	1354	1672	2020	2405
85	196.3	112.5	1.08	4.31	9.67	17.3	38.8	68.9	108.	155.	211.	276.	349	431	521	620	844	1103	1395	1723	2080	2480
90	207.9	115.8	1.11	4.43	9.95	17.7	39.9	70.8	111.	160.	217.	284.	359	443	536	638	868	1136	1436	1773	2140	2550
95	219.4	119.0	1.14	4.56	10.2	18.2	41.0	72.8	114.	164.	223.	292.	369	456	551	656	892	1168	1476	1824	2200	2625
100	230.9	122.0	1.17	4.67	10.5	18.7	42.1	74.7	117.	168.	229.	299.	378	467	565	672	915	1196	1512	1870	2255	2670
105	242.4	125.0	1.20	4.79	10.8	19.2	43.1	76.5	120.	172.	234.	306.	388	479	579	689	937	1226	1550	1916	2312	2755
110	254.0	128.0	1.23	4.90	11.0	19.6	44.1	78.4	122.	176.	240.	314.	397	490	593	705	960	1255	1588	1961	2366	2820
115	265.5	130.9	1.25	5.01	11.2	20.0	45.1	80.1	125.	180.	245.	320.	406	501	606	720	980	1282	1621	2005	2420	2885
120	277.1	133.7	1.28	5.12	11.5	20.5	46.0	81.8	128.	184.	251.	327.	414	512	619	736	1002	1310	1659	2050	2470	2945
125	288.6	136.4	1.31	5.22	11.7	20.9	47.0	83.5	130.	188.	256.	334.	423	522	632	751	1022	1338	1690	2090	2520	3005
130	300.2	139.1	1.33	5.33	12.0	21.3	48.0	85.2	133.	192.	261.	341.	432	533	645	767	1043	1365	1726	2132	2575	3070
135	311.7	141.8	1.36	5.43	12.2	21.7	48.9	86.7	136.	195.	266.	347.	439	543	656	780	1063	1390	1759	2173	2620	3125
140	323.3	144.3	1.38	5.53	12.4	22.1	49.8	88.4	138.	199.	271.	354.	448	553	668	795	1082	1415	1790	2212	2760	3180
145	334.8	146.9	1.41	5.62	12.6	22.5	50.6	89.9	140.	202.	275.	360.	455	562	680	809	1100	1440	1820	2250	2715	3235
150	346.4	149.5	1.43	5.72	12.9	22.9	51.6	91.5	143.	206.	280.	366.	463	572	692	824	1120	1466	1853	2290	2760	3295
175	104.1	161.4	1.55	6.18	13.9	24.7	55.6	98.8	154.	222.	302.	395.	500	618	747	890	1210	1582	2000	2473	2985	3560
200	451.9	172.6	1.65	6.61	14.8	26.4	59.5	105.	165.	238.	323.	423.	535	660	799	950	1294	1691	2140	2645	3190	3800
250	577.4	193.0	1.85	7.39	16.6	29.6	66.5	118.	185.	266.	362.	473.	598	739	894	1063	1447	1891	2392	2955	3570	4250
300	692.8	211.2	2.02	8.08	18.2	32.4	72.8	129.	202.	291.	396.	517.	655	808	977	1163	1582	2070	2615	3235	3900	4650

The actual quantity discharged by a nozzle will be less than above table. A well tapered smooth nozzle may be assumed to give about 94 per cent of the values in the tables:

Feet Head	Pressure per sq. in.	Feet Head	Pressure per sq. in.	Feet Head	Pressure per sq. in.	Feet Head	Pressure per sq. in.	Feet Head	Pressure per sq. in.	Feet Head	Pressure per sq. in.
1	0.43	54	23.39	107	46.34	160	69.31	213	92.25	285	123.45
2	0.86	55	23.82	108	46.78	161	69.74	214	92.69	290	125.62
3	1.30	56	24.25	109	47.21	162	70.17	215	93.13	295	127.78
4	1.73	57	24.69	110	47.64	163	70.61	216	93.56	300	129.95
5	2.16	58	25.12	111	48.08	164	71.04	217	93.99	305	132.12
6	2.60	59	25.55	112	48.51	165	71.47	218	94.43	310	134.28
7	3.03	60	25.99	113	48.94	166	71.91	219	94.86	315	136.46
8	3.46	61	26.42	114	49.38	167	72.34	220	95.30	320	138.62
9	3.90	62	26.85	115	49.81	168	72.77	221	95.73	325	140.79
10	4.33	63	27.29	116	50.24	169	73.20	222	96.16	330	142.95
11	4.76	64	27.72	117	50.68	170	73.64	223	96.60	335	145.12
12	5.20	65	28.15	118	51.11	171	74.07	224	97.03	340	147.28
13	5.63	66	28.58	119	51.54	172	74.50	225	97.46	345	149.45
14	6.06	67	29.02	120	51.98	173	74.94	226	97.90	350	151.61
15	6.50	68	29.45	121	52.41	174	75.37	227	98.33	355	153.78
16	6.93	69	29.88	122	52.84	175	75.80	228	98.76	360	155.94
17	7.36	70	30.32	123	53.28	176	76.23	229	99.20	365	158.10
18	7.80	71	30.75	124	53.71	177	76.67	230	99.63	370	160.27
19	8.23	72	31.18	125	54.15	178	77.10	231	100.00	375	162.45
20	8.66	73	31.62	126	54.58	179	77.53	232	100.49	380	164.61
21	9.09	74	32.05	127	55.01	180	77.97	233	100.93	385	166.78
22	9.53	75	32.48	128	55.44	181	78.40	234	101.36	390	168.94
23	9.96	76	32.92	129	55.88	182	78.84	235	101.78	395	171.11
24	10.39	77	33.35	130	56.31	183	79.27	236	102.23	400	173.27
25	10.82	78	33.78	131	56.74	184	79.70	237	102.66	425	184.10
26	11.26	79	34.21	132	57.18	185	80.14	238	103.09	450	194.89
27	11.69	80	34.65	133	57.61	186	80.57	239	103.53	475	205.77
28	12.12	81	35.08	134	58.04	187	81.00	240	103.96	500	216.58
29	12.55	82	35.52	135	58.48	188	81.43	241	104.39	525	227.42
30	12.99	83	35.95	136	58.91	189	81.87	242	104.83	550	238.25
31	13.42	84	36.39	137	59.34	190	82.30	243	105.26	575	249.09
32	13.86	85	36.82	138	59.77	191	82.73	244	105.69	600	259.90
33	14.29	86	37.25	139	60.21	192	83.17	245	106.13	625	270.73
34	14.72	87	37.68	140	60.64	193	83.60	246	106.56	650	281.56
35	15.16	88	38.12	141	61.07	194	84.03	247	106.99	675	292.40
36	15.59	89	38.55	142	61.51	195	84.47	248	107.43	700	303.22
37	16.02	90	38.98	143	61.94	196	84.90	249	107.86	725	314.00
38	16.45	91	39.42	144	62.37	197	85.33	250	108.29	750	324.88
39	16.89	92	39.85	145	62.81	198	85.76	251	108.73	775	335.72
40	17.32	93	40.28	146	63.24	199	86.20	252	109.16	800	346.54
41	17.75	94	40.72	147	63.67	200	86.63	253	109.59	825	357.37
42	18.19	95	41.15	148	64.10	201	87.07	254	110.03	850	368.20
43	18.62	96	41.58	149	64.54	202	87.50	255	110.46	875	379.03
44	19.05	97	42.01	150	64.97	203	87.93	256	110.89	900	389.86
45	19.49	98	42.45	151	65.40	204	88.36	257	111.32	925	400.70
46	19.92	99	42.88	152	65.84	205	88.80	258	111.76	950	411.54
47	20.35	100	43.31	153	66.27	206	89.21	259	112.19	975	422.35
48	20.79	101	43.75	154	66.70	207	89.66	260	112.62	1000	433.18
49	21.22	102	44.18	155	67.14	208	90.10	261	113.06	1500	649.70
50	21.65	103	44.61	156	67.57	209	90.53	262	113.49	2000	866.30
51	22.09	104	45.05	157	68.00	210	90.96	270	116.96	3000	1.299.50
52	22.52	105	45.48	158	68.43	211	91.39	275	119.12		
53	22.95	106	45.91	159	68.87	212	91.83	280	121.29		

Friction of Water in Pipes

For smooth new wrought iron pipe, multiply friction values by .71. For old W.I. pipe multiply by 1.52.

Loss of Head in Feet Due to Friction, per 100 Feet of New Ordinary Iron Pipe.

U.S. Gallons per Minute	½" Pipe		¾" Pipe		1" Pipe		1¼" Pipe		1½" Pipe		2" Pipe		2½" Pipe		3" Pipe	
	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.
1	1.05	2.1	......	......	......	......	......	......	......	......	......	......	......	......	......	......
2	2.10	7.4	1.20	1.9	......	......	......	......	......	......	......	......	......	......	......	......
3	3.16	15.8	1.80	4.1	1.12	1.26	......	......	......	......	......	......	......	......	......	......
4	4.21	27.0	2.41	7.0	1.49	2.14	0.86	0.57	0.63	0.26	......	......	......	......	......	......
5	5.26	41.0	3.01	10.5	1.86	3.25	1.07	0.84	0.79	0.39	......	......	......	......	......	......
10	10.52	147.0	6.02	38.0	3.72	11.7	2.14	3.05	1.57	1.43	1.02	0.50	0.65	0.17	0.45	0.07
15	......	......	9.02	80.0	5.60	25.0	3.2	6.50	2.36	3.0	1.53	1.0	0.98	0.36	0.68	0.15
20	......	......	12.03	136.0	7.44	42.0	4.29	11.1	3.15	5.2	2.04	1.82	1.31	0.61	0.91	0.25
25	......	......	......	......	9.30	64.0	5.36	16.6	3.94	7.8	2.55	2.73	1.63	0.92	1.13	0.38
30	......	......	......	......	11.15	89.0	6.43	23.5	4.72	11.0	3.06	3.84	1.96	1.29	1.36	0.54
35	......	......	......	......	13.02	119.0	7.51	31.2	5.51	14.7	3.57	5.1	2.29	1.72	1.59	0.71
40	......	......	......	......	14.88	152.0	8.58	40.0	6.3	18.8	4.08	6.6	2.61	2.20	1.82	0.91
45	......	......	......	......	......	......	9.65	50	7.08	23.2	4.60	8.2	2.94	2.80	2.05	1.15
50	......	......	......	......	......	......	10.72	60	7.87	28.4	5.11	9.9	3.27	3.32	2.27	1.38
70	......	......	......	......	......	......	15.01	113	11.02	53.0	7.15	18.4	4.58	6.2	3.18	2.57
90	......	......	......	......	......	......	......	......	14.17	84.0	9.19	29.4	5.88	9.8	4.09	4.08
100	......	......	......	......	......	......	......	......	15.74	102.0	10.21	35.8	6.54	12.0	4.54	4.96
120	......	......	......	......	......	......	......	......	18.89	143.0	12.25	50.0	7.84	16.8	5.45	7.0
140	......	......	......	......	......	......	......	......	22.04	190.0	14.30	67.0	9.15	22.3	6.35	9.2
160	......	......	......	......	......	......	......	......	......	......	16.34	86.0	10.46	29.0	7.26	11.8
180	......	......	......	......	......	......	......	......	......	......	18.38	107.0	11.76	35.7	8.17	14.8
200	......	......	......	......	......	......	......	......	......	......	20.42	129.0	13.07	43.1	9.08	17.8
220	......	......	......	......	......	......	......	......	......	......	22.47	154.0	14.38	52.0	9.99	21.3
240	......	......	......	......	......	......	......	......	......	......	24.51	182.0	15.69	61.0	10.89	25.1
260	......	......	......	......	......	......	......	......	......	......	26.55	211.0	16.99	70.0	11.80	29.1
280	......	......	......	......	......	......	......	......	......	......	......	......	18.30	81.0	12.71	33.4
300	......	......	......	......	......	......	......	......	......	......	......	......	19.61	92.0	13.62	38.0

Loss of Head in Feet Due to Friction, per 100 Feet of New Ordinary Cast Iron Pipe.

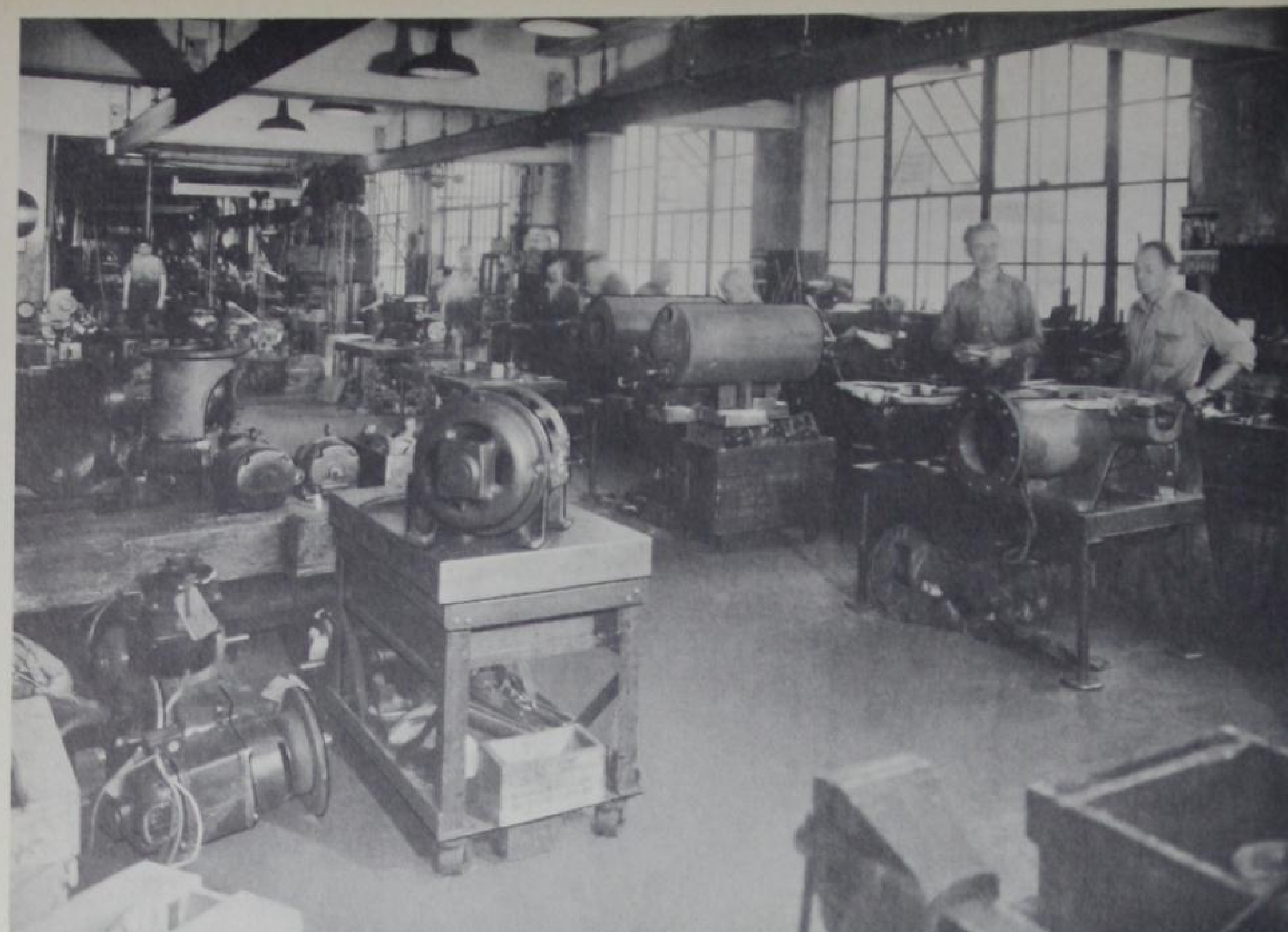
U.S. Gallons per Minute	4" Pipe		5" Pipe		6" Pipe		8" Pipe		10" Pipe		12" Pipe		14" Pipe		15" Pipe		16" Pipe		20" Pipe	
	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.
40	1.02	0.22	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
45	1.17	0.28	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
50	1.28	0.34	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
70	1.79	0.63	1.14	0.21	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
75	1.92	0.73	1.22	0.24	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
100	2.55	1.23	1.63	0.39	1.14	0.14	......	......	......	......	......	......	......	......	......	......	......	......	......	......
120	3.06	1.71	1.96	0.57	1.42	0.25	......	......	......	......	......	......	......	......	......	......	......	......	......	......
125	3.19	1.86	2.04	0.64	1.48	0.28	......	......	......	......	......	......	......	......	......	......	......	......	......	......
150	3.84	2.55	2.45	0.88	1.71	0.32	......	......	......	......	......	......	......	......	......	......	......	......	......	......
175	4.45	3.36	2.86	1.18	2.00	0.48	......	......	......	......	......	......	......	......	......	......	......	......	......	......
200	5.11	4.37	3.27	1.48	2.28	0.62	......	......	......	......	......	......	......	......	......	......	......	......	......	......
225	6.32	6.61	3.67	1.86	2.57	0.74	......	......	......	......	......	......	......	......	......	......	......	......	......	......
250	6.40	6.72	4.08	2.24	2.80	0.92	1.60	0.22	......	......	......	......	......	......	......	......	......	......	......	......
275	7.03	7.99	4.50	2.72	3.06	1.15	1.73	0.27	......	......	......	......	......	......	......	......	......	......	......	......
300	7.66	9.38	4.90	3.15	3.40	1.29	1.90	0.36	......	......	......	......	......	......	......	......	......	......	......	......
350	8.90	12.32	5.72	4.19	3.98	1.69	2.20	0.41	......	......	......	......	......	......	......	......	......	......	......	......
400	10.20	15.82	6.54	5.33	4.54	2.21	2.60	0.56	......	......	......	......	......	......	......	......	......	......	......	......
450	11.50	19.74	7.35	6.65	5.12	2.74	2.92	0.64	1.80	0.21	......	......	......	......	......	......	......	......	......	......
475	12.30	22.96	7.88	7.22	5.55	3.21	3.10	0.79	1.94	0.25	......	......	......	......	......	......	......	......	......	......
500	12.77	24.08	8.17	8.12	5.60	3.26	3.20	0.81	2.04	0.28	1.42	0.11	......	......	......	......	......	......	......	......
550	......	......	8.99	9.66	6.16	3.93	3.52	0.98	2.25	0.33	1.57	0.14	......	......	......	......	......	......	......	......
600	......	......	9.80	11.34	6.72	4.70	3.84	1.16	2.46	0.39	1.71	0.15	......	......	......	......	......	......	......	......
650	......	......	10.62	13.16	7.28	5.50	4.16	1.34	2.66	0.46	1.85	0.19	1.37	0.09	......	......	......	......	......	......
700	......	......	11.44	15.12	7.84	6.38	4.46	1.54	2.86	0.52	2.00	0.22	1.47	0.10	......	......	......	......	......	......
750	......	......	12.26	17.22	8.50	7.00	4.80	1.74	3.06	0.59	2.13	0.24	1.58	0.11	......	......	......	......	......	......
800	......	......	......	......	9.08	7.90	5.12	1.97	3.28	0.67	2.27	0.27	1.68	0.13	......	......	......	......	......	......
850	......	......	......	......	9.58	8.75	5.48	2.28	3.48	0.75	2.41	0.31	1.79	0.14	......	......	......	......	......	......
900	......	......	......	......	10.30	10.11	5.75	2.46	3.68	0.83	2.56	0.34	1.89	0.16	......	......	......	......	......	......
950	......	......	......	......	10.72	10.71	6.06	2.87	3.88	0.91	2.70	0.35	2.00	0.16	1.73	0.12	......	......	......	......
1000	......	......	......	......	11.32	12.04	6.40	3.02	4.08	1.01	2.84	0.41	2.10	0.19	1.83	0.14	......	......	......	......
1100	......	......	......	......	12.50	14.31	7.03	3.51	4.50	1.20	3.13	0.49	2.31	0.23	2.00	0.16	......	......	......	......
1200	......	......	......	......	13.52	16.69	7.67	4.26	4.91	1.46	3.41	0.57	2.52	0.26	2.18	0.19	......	......	......	......
1500	......	......	......	......	......	......	9.60	6.27	6.10	2.09	4.20	0.85	3.15	0.39	2.73	0.28	2.39	0.24	......	......
2000	......	......	......	......	......	......	12.70	10.71	8.10	3.50	5.60	1.43	4.20	0.66	3.64	0.47	3.19	0.39	......	......
2500	......	......	......	......	......	......	......	......	10.10	5.33	7.00	2.18	5.25	1.01	4.55	0.72	3.99	0.56	......	......
3000	......	......	......	......	......	......	......	......	12.10	7.42	8.40	3.39	6.30	1.57	5.46	1.12	4.79	0.80	3.08	0.27

Vel.—Velocity feet per second. Fric.—Friction head in feet.

Friction of Water in 90° Elbows

Equivalent Number of Feet Straight Pipe

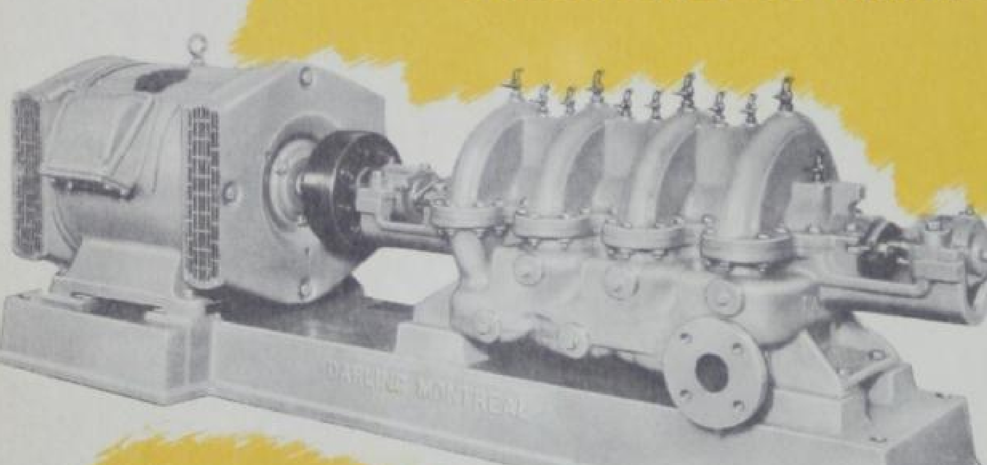
Size of Elbow, Inches.......	½	¾	1	1¼	1½	2	2½	3	4	5	6	8	10	12	14	15	16	20
Friction Equivalent Feet Straight Pipe...........	5	6	6	8	8	8	11	15	16	18	18	24	30	40	54	55	55	70



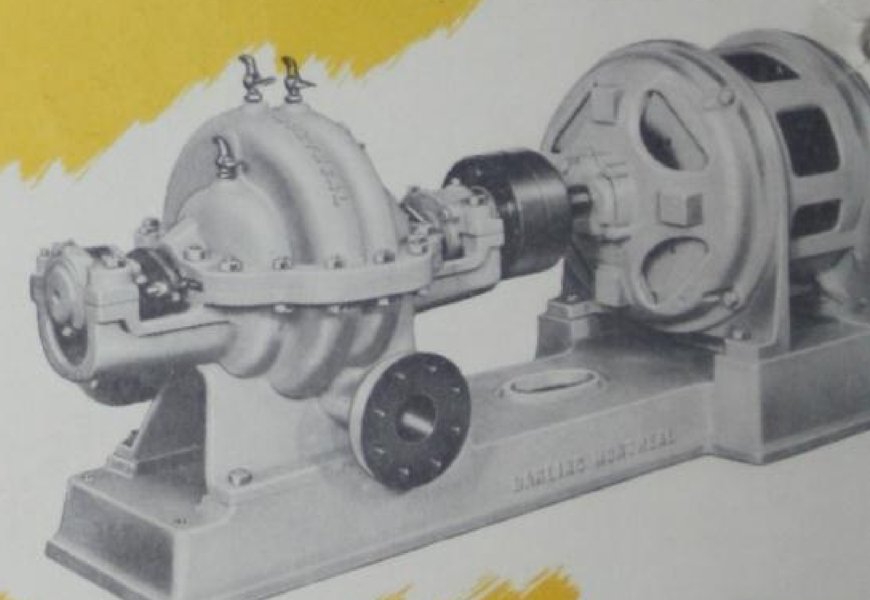
Pump Assembly Floor

Darlin
Vertic
Marin
Centri
Pump

OTHER TYPES OF DARLING CENTRIFUGAL PUMPS



Darling 4-Stage Type "BMS" Horizontal Split Case Centrifugal Pump



Darling 2-Stage Type "BES" Opposed Impeller Horizontal Centrifugal Pump

Darling 2-Stage Centrifugal Boiler Feed Pump

Darling Vertical Class "B" Pump

OVER 60 YEARS OF PROGRESS

DARLING BROTHERS LIMITED

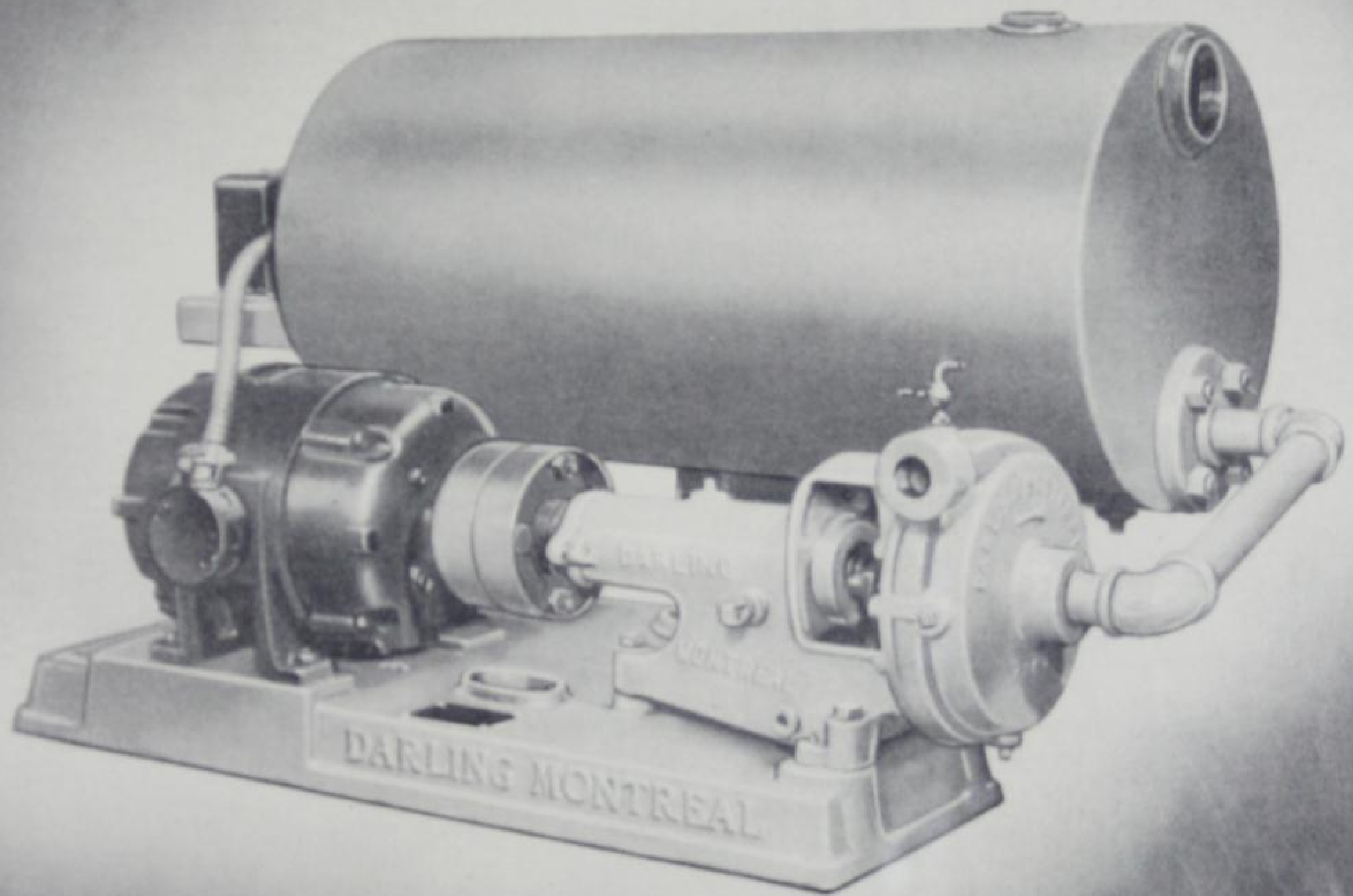
140 PRINCE ST. MONTREAL, CANADA

HALIFAX • SAINT JOHN • QUEBEC • ARVIDA • TIMMINS
OTTAWA • TORONTO • WINNIPEG • CALGARY • VANCOUVER • ST JOHN'S, NFLD.

Bulletin 45D

Darling

AUTOMATIC CONDENSATION PUMPS - - CLASS DC



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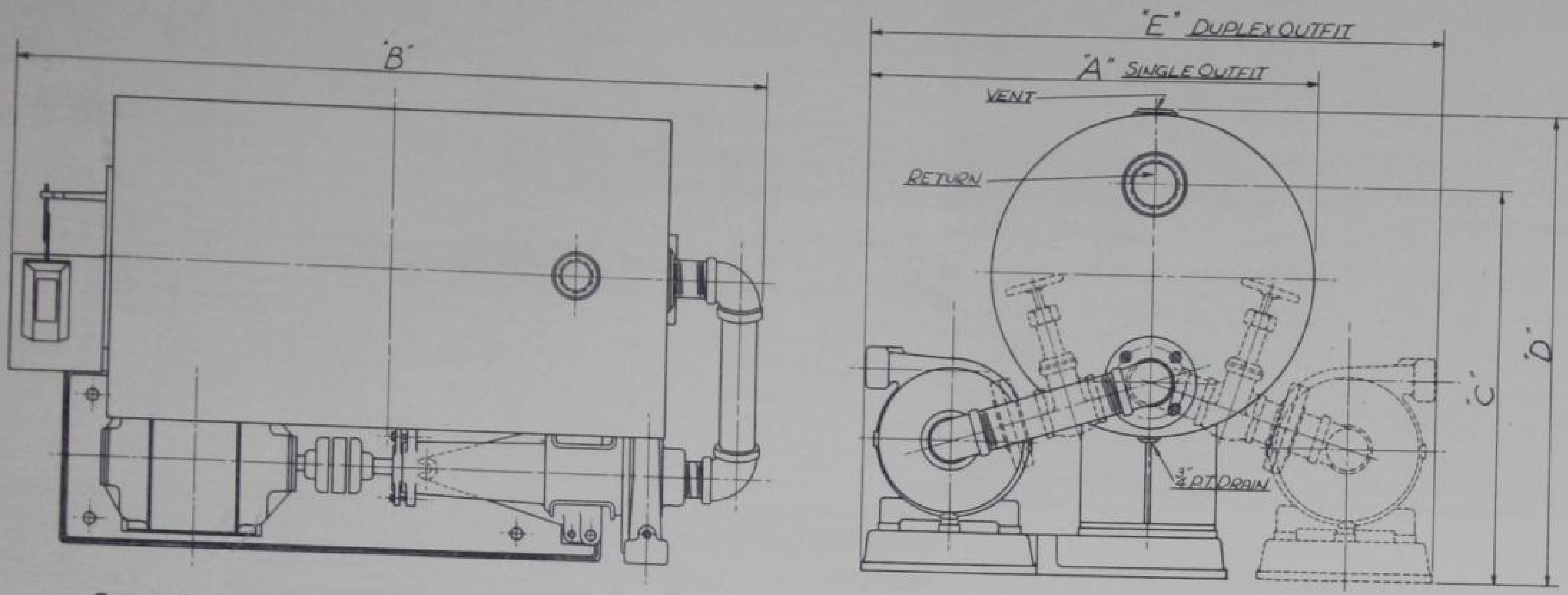
RATING TABLE

Cap. Sq. Ft. Radiation	Pressure Lbs.	U.S. Gals. Condensate	Approx. Boiler H.P.	Cap. Pump U.S. Gals.	Receiver		60 Cy. 1750 Revolutions Per Min.					25 Cy. 1440 Revolutions Per Min.				
					Size	Cap'ty U.S. Gals.	Size & Type of Pump	Motor H.P.	Wt. Lbs.	Outfit No.	Dimensions No.	Size & Type of Pump	Motor H.P.	Wt. Lbs.	Outfit No.	Dimensions No.
4,000	15	2	40	6	17″x20″	23	¾ DAAC	⅓	425	4DC15	1	¾ DAAC	⅓	435	4DC14	1
	25	2	40	6	17″x20″	23	¾ DAAC	½	440	4DC25	2	¾ DAAC	½	440	4DC24	2
	30	2	40	6	17″x20″	23	¾ DAAC	¾	440	4DC30	2	¾ DAYC	¾	510	4DC29	2
	35	2	40	6	17″x20″	23	¾ DAYC	1	510	4DC35	2	¾ DAYC	1	540	4DC34	2
	45	2	40	6	17″x20″	23	¾ DAYC	1½	540	4DC45	2	¾ DAYC	1½	550	4DC44	2
	50	2	40	6	17″x20″	23	¾ DAYC	2	550	4DC50	2	¾ DAYC	2	550	4DC49	2
	60	2	40	6	17″x20″	23	¾ DAYC	3	550	4DC60	2					
6,000	15	3	60	9	17″x20″	23	¾ DAAC	⅓	425	6DC15	1	¾ DAAC	⅓	435	6DC14	1
	20	3	60	9	17″x20″	23	¾ DAAC	½	440	6DC20	2	¾ DAAC	½	440	6DC19	2
	25	3	60	9	17″x20″	23	¾ DAAC	¾	440	6DC25	2	¾ DAYC	¾	510	6DC24	2
	35	3	60	9	17″x20″	23	¾ DAYC	1	510	6DC35	2	¾ DAYC	1	540	6DC34	2
	40	3	60	9	17″x20″	23	¾ DAYC	1½	540	6DC40	2	¾ DAYC	1½	550	6DC39	2
	45	3	60	9	17″x20″	23	¾ DAYC	2	550	6DC45	2	¾ DAYC	2	550	6DC44	2
	60	3	60	9	17″x20″	23	¾ DAYC	3	550	6DC60	2					
8,000	10	4	80	12	18″x24″	28	¾ DAAC	⅓	420	8DC10	3	¾ DAAC	⅓	450	8DC9	3
	20	4	80	12	18″x24″	28	¾ DAAC	½	455	8DC20	4	¾ DAAC	½	460	8DC19	4
	25	4	80	12	18″x24″	28	¾ DAAC	¾	455	8DC25	4	¾ DAYC	¾	530	8DC24	4
	30	4	80	12	18″x24″	28	¾ DAAC	1	470	8DC30	4	¾ DAYC	1	560	8DC29	4
	40	4	80	12	18″x24″	28	¾ DAYC	1½	555	8DC40	4	¾ DAYC	1½	570	8DC39	4
	45	4	80	12	18″x24″	28	¾ DAYC	2	565	8DC45	4	¾ DAYC	2	570	8DC44	4
	60	4	80	12	18″x24″	28	¾ DAYC	3	565	8DC60	4					
10,000	10	5	100	15	18″x24″	28	1 DAAC	⅓	430	10DC10	3	1 DAAC	⅓	455	10DC9	3
	15	5	100	15	18″x24″	28	1 DAAC	½	455	10DC15	4	1 DAAC	½	460	10DC14	4
	25	5	100	15	18″x24″	28	¾ DAAC	¾	455	10DC25	4	¾ DAYC	¾	530	10DC24	4
	30	5	100	15	18″x24″	28	¾ DAAC	1	470	10DC30	4	¾ DAYC	1	560	10DC29	4
	35	5	100	15	18″x24″	28	¾ DAYC	1½	555	10DC35	4	¾ DAYC	1½	570	10DC34	4
	45	5	100	15	18″x24″	28	¾ DAYC	2	565	10DC45	4	¾ DAYC	2	570	10DC44	4
	60	5	100	15	18″x24″	28	¾ DAYC	3	565	10DC60	4					
15,000	15	7.5	150	22.5	18″x36″	42	1 DAAC	½	485	15DC15	5	1 DAAC	½	480	15DC14	5
	20	7.5	150	22.5	18″x36″	42	1 DAAC	¾	485	15DC20	5	1 DAAC	¾	500	15DC19	5
	25	7.5	150	22.5	18″x36″	42	1 DAAC	1	500	15DC25	5	1 DAYC	1	595	15DC24	5
	35	7.5	150	22.5	18″x36″	42	1 DAYC	1½	595	15DC35	5	1 DAYC	1½	605	15DC34	5
	40	7.5	150	22.5	18″x36″	42	1 DAYC	2	605	15DC40	5	1 DAYC	2	605	15DC39	5
	50	7.5	150	22.5	18″x36″	42	¾ DAYC	3	590	15DC50	5	1 DAYC	3	660	15DC49	6
	60	7.5	150	22.5	18″x36″	42	¾ DAYC	5	645	15DC60	6					
20,000	10	10	200	30	18″x36″	42	1¼ DAAC	½	450	20DC10	7	1¼ DAAC	½	490	20DC9	5
	20	10	200	30	18″x36″	42	1¼ DAAC	¾	485	20DC20	5	1¼ DAAC	¾	500	20DC19	5
	25	10	200	30	18″x36″	42	1 DAAC	1	500	20DC25	5	1¼ DAYC	1	600	20DC24	5
	30	10	200	30	18″x36″	42	1 DAAC	1½	525	20DC30	5	1 DAYC	1½	600	20DC29	5
	35	10	200	30	18″x36″	42	1 DAYC	2	600	20DC35	5	1 DAYC	2	600	20DC34	5
	45	10	200	30	18″x36″	42	1 DAYC	3	600	20DC45	5	1¼ DAYC	3	670	20DC44	6
	60	10	200	30	18″x36″	42	1 DAYC	5	660	20DC60	6					
25,000	10	12.5	250	37.5	21″x36″	54	1¼ DAAC	½	465	25DC10	8	1¼ DAAC	½	500	25DC9	9
	15	12.5	250	37.5	21″x36″	54	1¼ DAAC	¾	500	25DC15	9	1¼ DAAC	¾	520	25DC14	9
	20	12.5	250	37.5	21″x36″	54	1¼ DAAC	1	515	25DC20	9	1¼ DAAC	1	550	25DC19	9
	30	12.5	250	37.5	21″x36″	54	1¼ DAAC	1½	550	25DC30	9	1¼ DAYC	1½	625	25DC29	9
	35	12.5	250	37.5	21″x36″	54	1 DAYC	2	620	25DC35	9	1¼ DAYC	2	625	25DC34	9
	45	12.5	250	37.5	21″x36″	54	1 DAYC	3	620	25DC45	9	1¼ DAYC	3	680	25DC44	10
	60	12.5	250	37.5	21″x36″	54	1 DAYC	5	675	25DC60	10					
30,000	10	15	300	45	24″x36″	74	1½ DAAC	¾	470	30DC10	8	1½ DAAC	¾	520	30DC9	9
	15	15	300	45	24″x36″	74	1½ DAAC	¾	510	30DC15	9	1½ DAAC	¾	520	30DC14	9
	20	15	300	45	24″x36″	74	1½ DAAC	1	520	30DC20	9	1½ DAAC	1	550	30DC19	9
	25	15	300	45	24″x36″	74	1¼ DAAC	1½	550	30DC25	9	1¼ DAYC	1½	625	30DC24	9
	30	15	300	45	24″x36″	74	1¼ DAAC	2	560	30DC30	9	1¼ DAYC	2	625	30DC29	9
	40	15	300	45	24″x36″	74	1¼ DAYC	3	625	30DC40	9	1¼ DAYC	3	680	30DC39	10
	60	15	300	45	24″x36″	74	1 DAYC	5	680	30DC60	10	1¼ DAYC	5	750	30DC49	10
35,000	10	17.5	350	52.5	24″x36″	74	1½ DAAC	¾	470	35DC10	8	1½ DAAC	¾	520	35DC9	9
	15	17.5	350	52.5	24″x36″	74	1½ DAAC	1	520	35DC15	9	1½ DAAC	1	550	35DC14	9
	25	17.5	350	52.5	24″x36″	74	1½ DAAC	1½	550	35DC25	9	1½ DAYC	1½	620	35DC24	9
	30	17.5	350	52.5	24″x36″	74	1½ DAAC	2	560	35DC30	9	1½ DAYC	2	620	35DC29	9
	35	17.5	350	52.5	24″x36″	74	1¼ DAYC	3	620	35DC35	9	1½ DAYC	3	680	35DC34	10
	60	17.5	350	52.5	24″x36″	74	1¼ DAYC	5	680	35DC60	10	1½ DAYC	5	750	35DC49	10
40,000	10	20	400	60	24″x48″	95	1½ DAAC	1	540	40DC10	11	1½ DAAC	1	600	40DC9	11
	15	20	400	60	24″x48″	95	1½ DAAC	1	575	40DC15	11	1½ DAAC	1	600	40DC14	11
	25	20	400	60	24″x48″	95	1½ DAAC	1½	605	40DC25	11	1½ DAYC	1½	670	40DC24	11
	30	20	400	60	24″x48″	95	1½ DAAC	2	615	40DC30	11	1½ DAYC	2	670	40DC29	11
	35	20	400	60	24″x48″	95	1½ DAYC	3	680	40DC35	11	1½ DAYC	3	725	40DC34	12
	50	20	400	60	24″x48″	95	1¼ DAYC	5	735	40DC50	12	1½ DAYC	5	800	40DC49	12
	60	20	400	60	24″x48″	95	1¼ DAYC	7½	810	40DC60	12					
50,000	10	25	500	75	24″x48″	95	1½ DAAC	1	540	50DC10	11	1½ DAAC	1	600	50DC9	11
	20	25	500	75	24″x48″	95	1½ DAAC	1½	575	50DC20	11	1½ DAAC	1½	610	50DC19	11
	25	25	500	75	24″x48″	95	1½ DAAC	2	615	50DC25	11	1½ DAYC	2	670	50DC24	11
	30	25	500	75	24″x48″	95	1½ DAAC	3	615	50DC30	11	1½ DAYC	3	725	50DC29	12
	35	25	500	75	24″x48″	95	1½ DAYC	3	680	50DC35	11	1½ DAYC	3	725	50DC34	12
	50	25	500	75	24″x48″	95	1½ DAYC	5	735	50DC50	12	1½ DAYC	5	800	50DC49	12
	60	25	500	75	24″x48″	95	1½ DAYC	7½	810	50DC60	12					

OVERALL DIMENSIONS CLASS "DC" CONDENSATION PUMPS



Gate valves as shown above recommended for Duplex Units only but not furnished by Darling Brothers Limited.

Dimensions No.	Return	Vent	A	B	C	D	E
1	2″	1¼″	30″	41″	22¾″	25½″	41″
2	2″	1¼″	33″	46″	22¾″	25½″	46″
3	2½″	1¼″	30″	41″	23¾″	26½″	41″
4	2½″	1¼″	34″	46″	23¾″	26½″	46″
5	3″	1½″	34″	49″	24¾″	27½″	46″
6	3″	1½″	35″	50″	24¾″	27½″	48″
7	3″	1½″	30″	41″	24¾″	27½″	40″
8	3½″	2″	32″	47″	25¾″	30½″	40″
9	3½″	2″	34″	48″	25¾″	30½″	45″
10	3½″	2″	36″	49″	25¾″	30½″	47″
11	4″	2″	38″	55″	28¾″.	33½″	47″
12	4″	2″	40″	55″	28¾″	33½″	49″

TYPICAL SPECIFICATION

Furnish and install in location indicated on plans one (or duplex) No. ------ Darling Class "DC" condensation Return Unit with a capacity of-------- U.S. gallons per minute or------------ square feet of direct radiation against a pressure of ---------- pounds per sq. in., at pump. This figure includes allowance for pipe friction and elevation of boiler water line above pump.

Pump to be a Darling Class D. horizontal end suction type with overhung bronze enclosed hydraulically balanced impeller, keyed and mounted on tapered end of steel shaft running in deep groove ball bearings which are removed from all possibility of contact with the liquid being handled. All parts of the pump are to be positively located in position by machined shoulders and spigots.

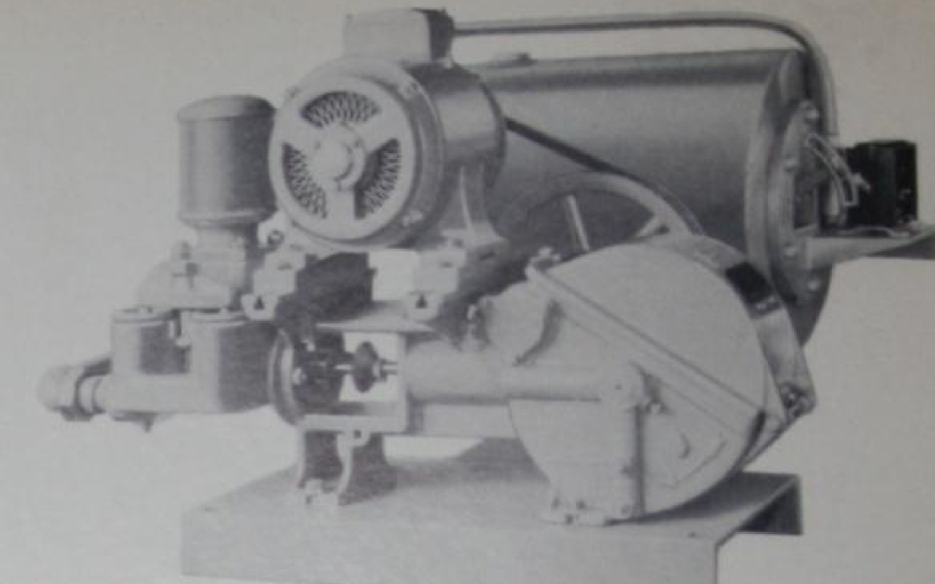
Pump to be driven through a cast iron flexible coupling with rubber buffers by a -----H.P.-----Ph.-----Cy.---- Volts, 40C. motor running at a maximum speed of 1800 revs.

The heavy steel receiver is to be equipped with bronze float and gear to actuate a butt contact float switch. An adjustment to be provided so that start and stop water levels in tank can be changed. Suitable thermal overload devices to protect motor are to be provided.

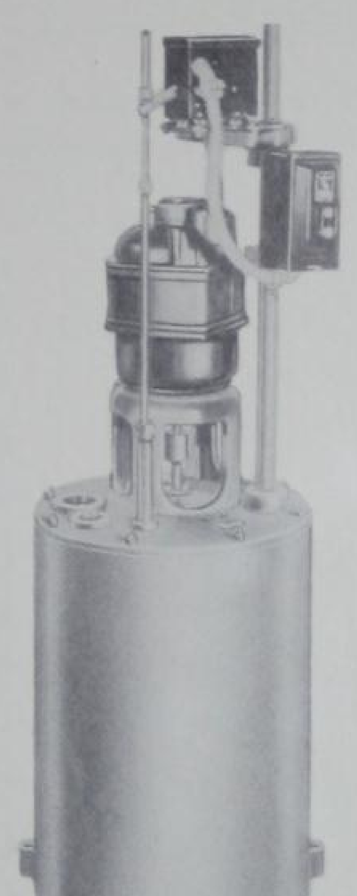
(If single unit having receiver smaller than 24″ x 48″ add the following paragraph)

All piping connections between pump and receiver and electrical wiring connections between float switch, starter if used, and motor, to be made by manufacturer. Pump, motor and receiver to be mounted on common cast iron baseplate.

OTHER TYPES OF DARLING ELECTRIC CONDENSATION PUMPS



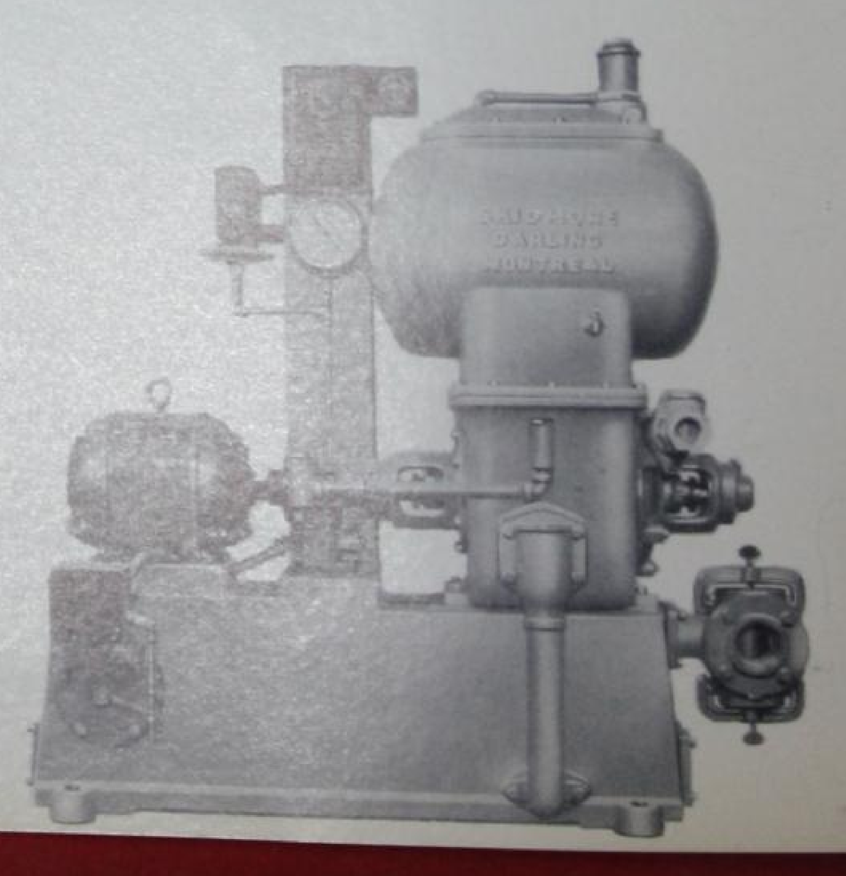
CLASS "PC" HORIZONTAL UNITS. Used with high pressure boilers, operating at pressures up to 250 lbs. per sq. in. Capacities from 10 to 200 boiler horse power.



SEPARATE CATALOGUES OF THESE UNITS ARE AVAILABLE

SKIDMORE DARLING AUTOMATIC VACUUM AND BOILER FEED PUMP, Used on Vacuum Heating Systems.

CLASS "VC" VERTICAL UNITS. Used where return mains are close to or below floor level. Made in sizes from 2000 to 50,000 sq. ft. e.d.r. with discharge pressures up to 50 lbs. per sq. in.



FRICTION OF WATER IN PIPES

Loss of Head in Feet Due to Friction, per 100 Feet of 15 year old Ordinary Iron Pipe

Vel.—Velocity in Feet per Second.
Fric.—Friction Head in Feet.

U.S. Gals. per Min.	½" Pipe		¾" Pipe		1" Pipe		1¼" Pipe		1½" Pipe		2" Pipe		2½" Pipe		3" Pipe		4" Pipe		5" Pipe		6" Pipe		8" Pipe	
	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric	Vel.	Fric	Vel.	Fric.	Vel.	Fric.	Vel.	Fric	Fric.	Vel.
1	1.05	2.1																						
2	2.10	7.4	1.20	1.9																				
3	3.16	15.8	1.80	4.1	1.12	1.26																		
4	4.21	27.0	2.41	7.0	1.49	2.14	0.86	0.57	0.63	0.26														
5	5.26	41.0	3.01	10.5	1.86	3.25	1.07	0.84	0.79	0.39														
10	10.52	147.0	6.02	38.0	3.72	11.7	2.14	3.05	1.57	1.43	1.02	0.50	0.65	0.17	0.45	0.07								
15			9.02	80.0	5.60	25.0	3.2	6.50	2.36	3.0	1.53	1.08	0.98	0.36	0.68	0.15								
20			12.03	135.0	7.44	42.0	4.29	11.1	3.15	5.2	2.01	1.82	1.31	0.61	0.91	0.25								
25					9.30	64.0	5.36	16.6	3.94	7.8	2.55	2.73	1.63	0.92	1.13	0.38								
30					11.15	89.0	6.43	23.5	4.72	11.0	3.06	3.84	1.96	1.29	1.36	0.54								
35					13.02	119.0	7.51	31.2	5.51	14.7	3.57	5.1	2.29	1.72	1.59	0.71								
40					14.88	152.0	8.58	40.0	6.3	18.8	4.08	6.6	2.61	2.20	1.82	0.91	1.02	0.22						
45							9.65	50.0	7.08	23.2	4.60	8.2	2.94	2.80	2.05	1.15	1.17	0.28						
50							10.72	60.0	7.87	28.4	5.11	9.9	3.27	3.32	2.27	1.38	1.28	0.34						
75									11.80	50.0	7.66	20.9	5.01	7.1	3.4	3.05	1.92	0.73	1.22	0.24				
100									15.74	102.0	10.21	35.8	6.54	12.0	4.54	4.95	2.55	1.23	1.63	0.39	1.14	0.14		
120									18.89	143.0	12.25	50.0	7.84	16.8	5.45	7.0	3.06	1.71	1.95	0.57	1.42	0.25		
140									22.04	190.0	14.30	67.0	9.15	22.3	6.35	9.2	3.57	2.28	2.29	0.76	1.58	0.31		
160											16.34	86.0	10.46	29.0	7.26	11.8	4.08	2.91	2.61	0.98	1.80	0.41		
180											18.38	107.0	11.76	35.7	8.17	14.8	4.60	3.61	2.94	1.22	2.04	0.50		

FRICTION TABLE OF WATER IN 90° ELBOWS

Equivalent Number of Feet Straight Pipe

Size of Elbow, Inches	½	¾	1	1¼	1½	2	2½	3	4	5	6	8
Friction Equivalent Feet Straight Pipe	5	6	6	8	8	8	11	15	16	18	18	24

FEET HEAD TO POUNDS PER SQUARE INCH

Feet Head	Pressure per sq. in.	Feet Head	Pressure per sq. in.	Feet Head	Pressure per sq. in.	Feet Head	Pressure per sq. in.	Feet Head	Pressure per sq. in.	Feet Head	Pressure per sq. in.
1	0.43	28	12.12	55	23.82	82	35.52	109	47.21	136	58.91
2	0.86	29	12.55	56	24.25	83	35.95	110	47.64	137	59.34
3	1.30	30	12.99	57	24.69	84	36.39	111	48.08	138	59.77
4	1.73	31	13.42	58	25.12	85	36.82	112	48.51	139	60.21
5	2.16	32	13.86	59	25.55	86	37.25	113	48.94	140	60.64
6	2.60	33	14.29	60	25.99	87	37.68	114	49.38	141	61.07
7	3.03	34	14.72	61	26.42	88	38.12	115	49.81	142	61.51
8	3.46	35	15.16	62	26.85	89	38.55	116	50.24	143	61.94
9	3.90	36	15.59	63	27.29	90	38.98	117	50.68	144	62.37
10	4.33	37	16.02	64	27.72	91	39.42	118	51.11	145	62.81
11	4.76	38	16.45	65	28.15	92	39.85	119	51.54	146	63.24
12	5.20	39	16.89	66	28.58	93	40.28	120	51.98	147	63.67
13	5.63	40	17.32	67	29.02	94	40.72	121	52.41	148	64.10
14	6.06	41	17.75	68	29.45	95	41.15	122	52.84	149	64.54
15	6.50	42	18.19	69	29.88	96	41.58	123	53.28	150	64.97
16	6.93	43	18.62	70	30.32	97	42.01	124	53.71	151	65.40
17	7.36	44	19.05	71	30.75	98	42.45	125	54.15	152	65.84
18	7.80	45	19.49	72	31.18	99	42.88	126	54.58	153	66.27
19	8.23	46	19.92	73	31.62	100	43.31	127	55.01	154	66.70
20	8.66	47	20.35	74	32.05	101	43.75	128	55.44	155	67.14
21	9.09	48	20.79	75	32.48	102	44.18	129	55.88	156	67.57
22	9.53	49	21.22	76	32.92	103	44.61	130	56.31	157	68.00
23	9.96	50	21.65	77	33.35	104	45.05	131	56.74	158	68.43
24	10.39	51	22.09	78	33.78	105	45.48	132	57.18	159	68.86
25	10.82	52	22.52	79	34.21	106	45.91	133	57.61	160	69.29
26	11.26	53	22.95	80	34.65	107	46.34	134	58.04	161	69.72
27	11.69	54	23.39	81	35.08	108	46.78	135	58.48	162	70.15

DUPLEX CLASS "DC" CONDENSATION PUMP UNITS

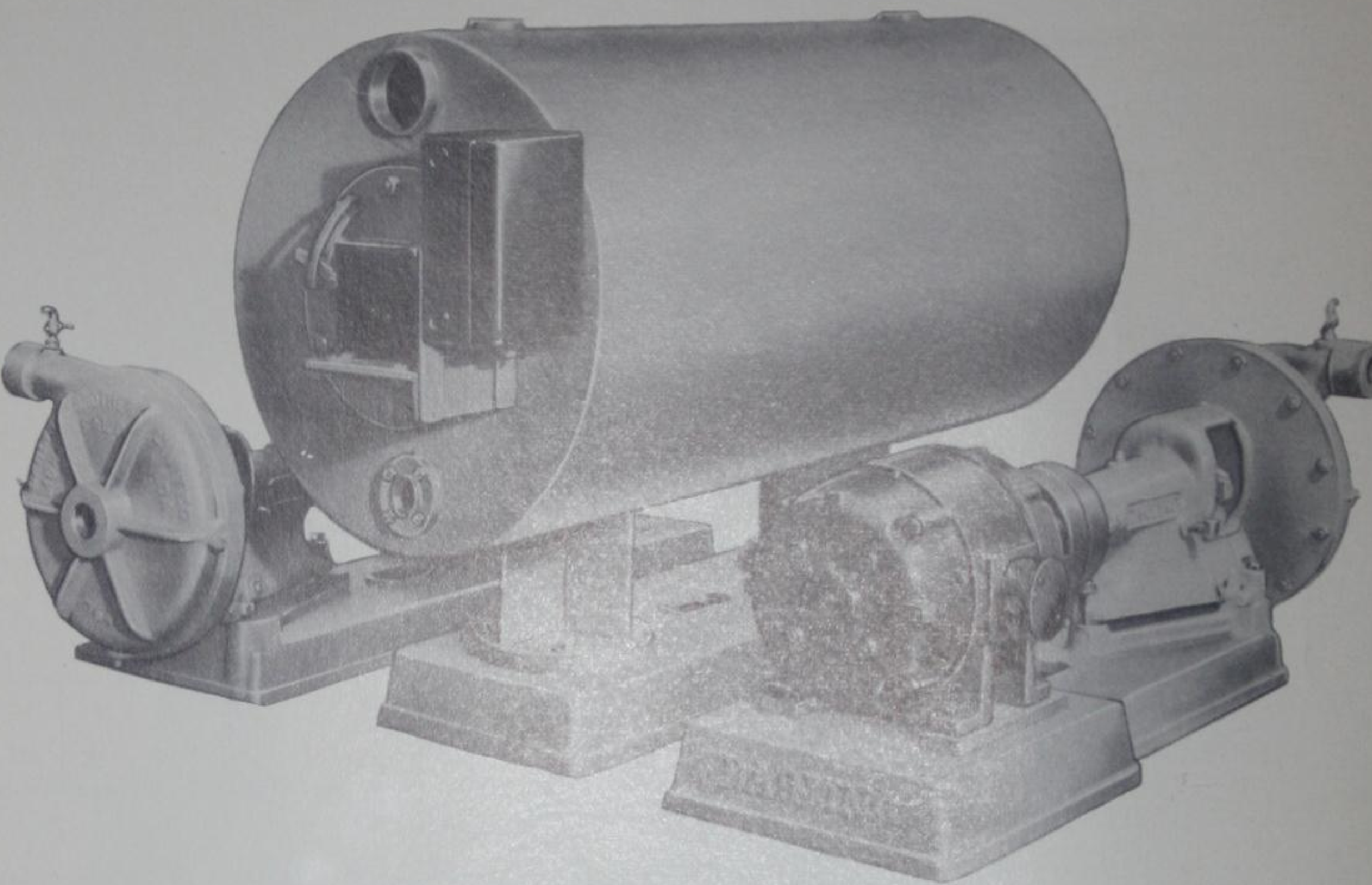
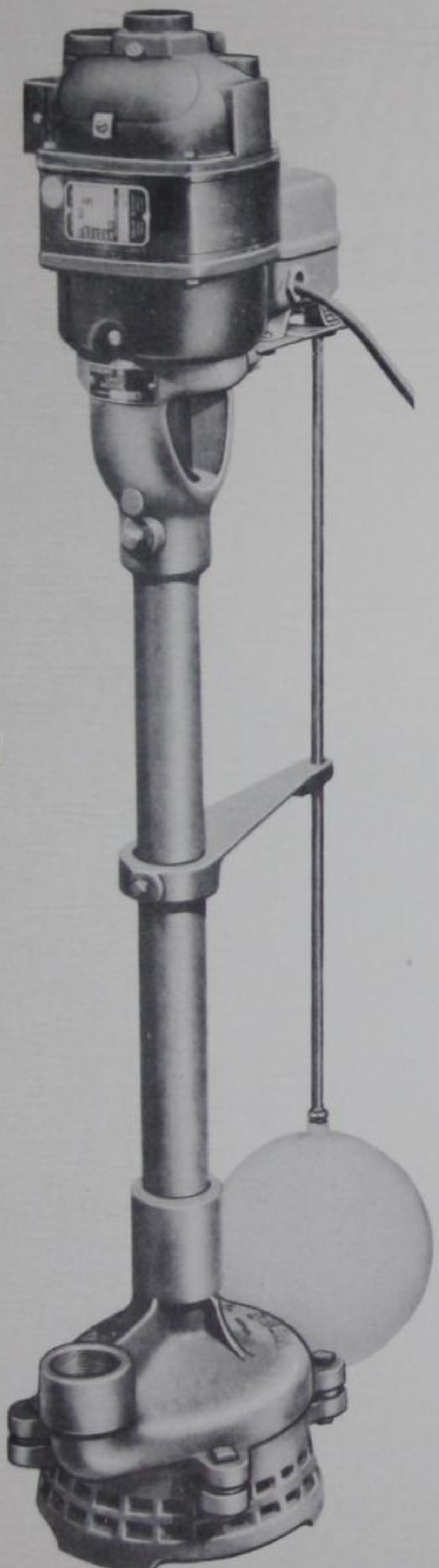


Illustration shows a typical arrangement of one of the larger sizes of Class "DC" duplex units, made up of one receiving tank and two pumps, one of which always acts as a standby. A float switch is mounted on each end of the receiver so that each pump has its own starting equipment as well as its own motor and is therefore entirely independent.

Printed in Canada

DARLING HEAVY DUTY ELECTRIC CELLAR DRAINER

This dependable, electric motor-driven pump has been designed and improved from long experience in practical installations, and is produced to the same high quality standards which have characterized all Darling Pumps for over sixty years. It has proved itself a profitable investment, with low maintenance costs, in draining boiler rooms, tunnels and elevator pits; and has been a valuable emergency unit for towns, manufacturing plants and institutions.



SPECIFICATIONS OF STANDARD UNIT

CASING: Volute type with 1½″ elbow discharge, cast integrally. Impeller can be removed without disconnecting discharge pipe from casing.

IMPELLER: Enclosed type machined all over outside, file finished water passages. Mechanically balanced. Radial clearance on hub to prevent seizing. Provision to take up wear. Well rounded vanes at entrance.

SHAFT: ¾″ diameter Ground Stainless Steel Shaft.

PUMP BEARING: Self-lubricating.

COLUMN: 1½″ extra heavy steel pipe, machined at ends for pump and frame sockets.

COVER: PUMP BASE: SCREEN: Combined casting.

MOTOR: ¼ or ⅓ h.p. (see capacity table), continuously rated, 1 phase, 60 cycle, 110/220 volt, 1750 R.P.M., ball bearing, Repulsion Induction Type High Torque with low starting current inrush. Totally enclosed explosion proof motors available for special application.

PROTECTION: Thermal overload protection with automatic reset is built into single phase motors.

STARTING: Heavy duty 1 h.p., 110 volt or 2 h.p., 220 volt, single phase rating, two pole float switch operated by a 7″ diameter seamless copper float and ⅛″ I.P.S. brass pipe.

SUMPS: Pumps are built for pits 24″, 36″ and 48″ deep, maximum. Minimum diameter pit 16″.

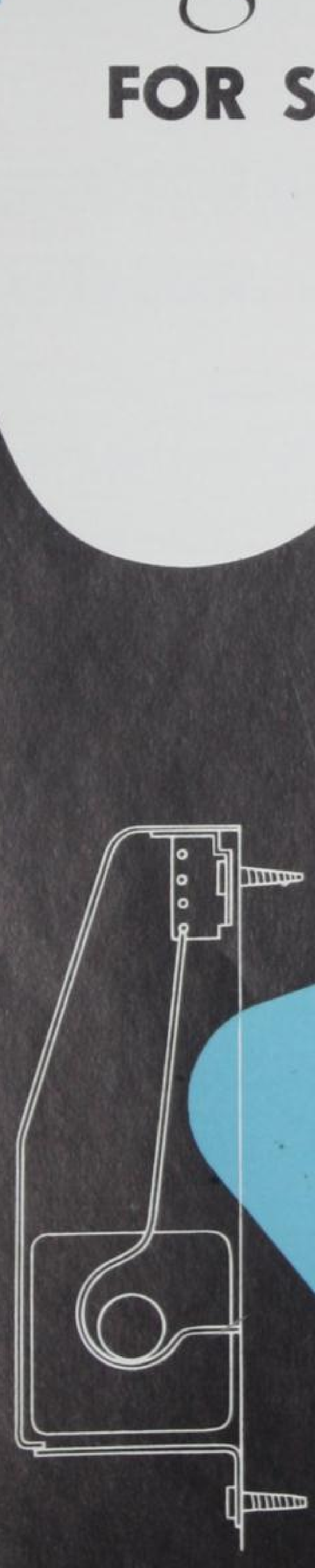
SUMP COVERS: Cast iron adjustable split covers are available for pits 16″, 20″ and 24″ diameter. Cover diameters, 20″, 24″ and 28″ respectively.

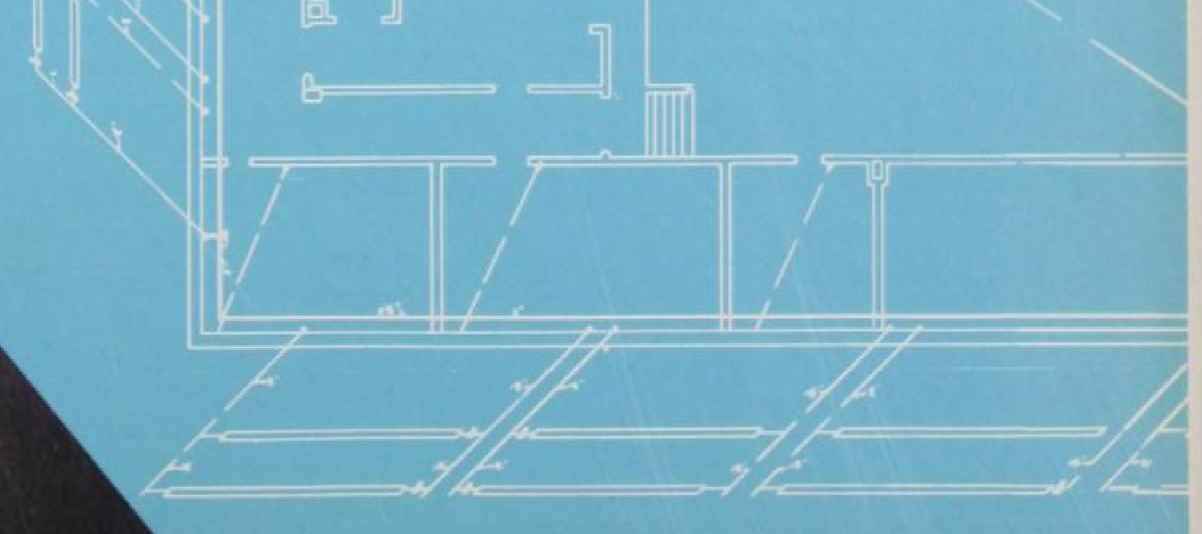
U.S. G. P. M. CAPACITY	HEAD IN FEET	
1750 R.P.M.	¼ H.P.	⅓ H.P.
10	19	26
20	18	25
30	15	23
40	12	20
50	4	14

designed FOR SCHOOLS

- GREATER COMFORT
- IMPROVED HEALTH
- BETTER ATTENDANCE
- HIGHER SCHOLARSHIP

Webster WALVECTOR
TRU-PERIMETER HEATING





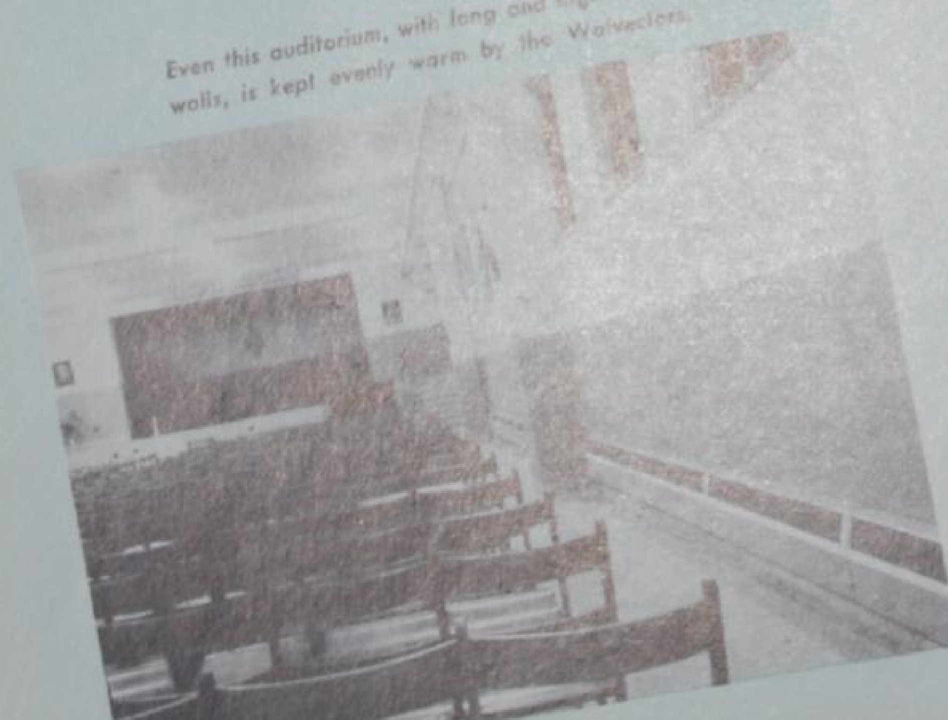
IN ARVIDA

Architects: Leonce Desgagne and Paul Boileau, Chicoutimi.
Consulting Engineers: J. J. [illegible], Chicoutimi.
General Contractor: J. W. [illegible], Jonquière.

L'ÉCOLE NOTRE-DAME de l'ASSOMPTION

Walvector units along exposed wall keep classrooms comfortable in extreme weather.

Even this auditorium, with long and high outside walls, is kept evenly warm by the Walvectors.



A Rigorous Test Case:

A glance at the photograph above shows the vast surface areas of the building, and especially the great total window area, which had to be considered in choosing the heating system for this fi school on Hudson Street. When the problem was intensified by extremely low temperatures, high winds, and often rapid changes in the course of a day, which prevail in this district, the matter of selecting adequate and dependable heating became doubly important.

The Choice Was Webster Walvector:

The responsible group, after thorough study of the available heating systems, chose Webster Walvector Tru-Perimeter Heating which was installed in such multiple units as the specific conditions of each room required. Yet the heating units did not interfere with useful space; and actually added to the simple attractiveness of the room scheme.

The Most Convincing Proof:

After the experience of a severe winter, the Arvida school authorities have decided to install Webster Walvector Tru-Perimeter Heating in two additional schools being erected in Arvida.

For an independent analysis of the applications an and Ventilation of School Buildings", by D. W. R.A.I.C., April 1952.

IN GRANBY

Architect: A. Leslie Perry, Montreal.
Consulting Engineer: John P. Dodson, P.E.Q., A.M.I.Mech. Eng., Granby.
General Contractors: R. E. Stewart Construction, Sherbrooke
Heating Contractors: Magog Plumbing & Heating Reg'd., Magog.

GRANBY HIGH SCHOOL

Another Outstanding Instance:

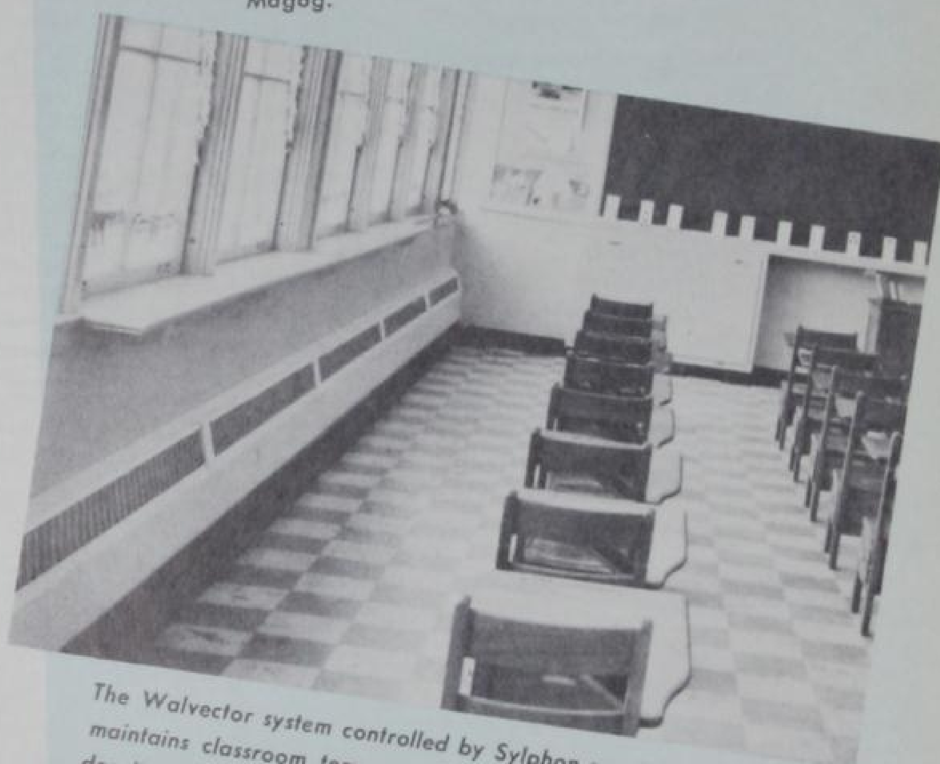
When Granby decided to build a large extension to its existing High School building—as shown by the section occupying the right-hand two-thirds of the photograph above, Webster Walvector Tru-Perimeter Heating was chosen and installed, with Sylphon Automatic Temperature Regulator Valves in each room.

Exact Records of Dependability Kept:

The teachers checked temperatures in each room and corridors several times daily on thermometers provided on the walls. During the severe winter immediately following and despite the location on the brow of a hill and open exposure, *in no room did the temperature vary more than two degrees from the determined comfort point.*

A Further Proof of Performance:

The building superintendent, Mr. Leland Cornish, has advised that the Webster Walvector system (in marked contrast to the system in the older wing) acts with remarkable rapidity. After week-ends when the building temperature is kept at a much lower point for economy of fuel, the regulators are reset for normal, *only fifteen minutes before school opening time, and perfect comfort is established in that short period.*



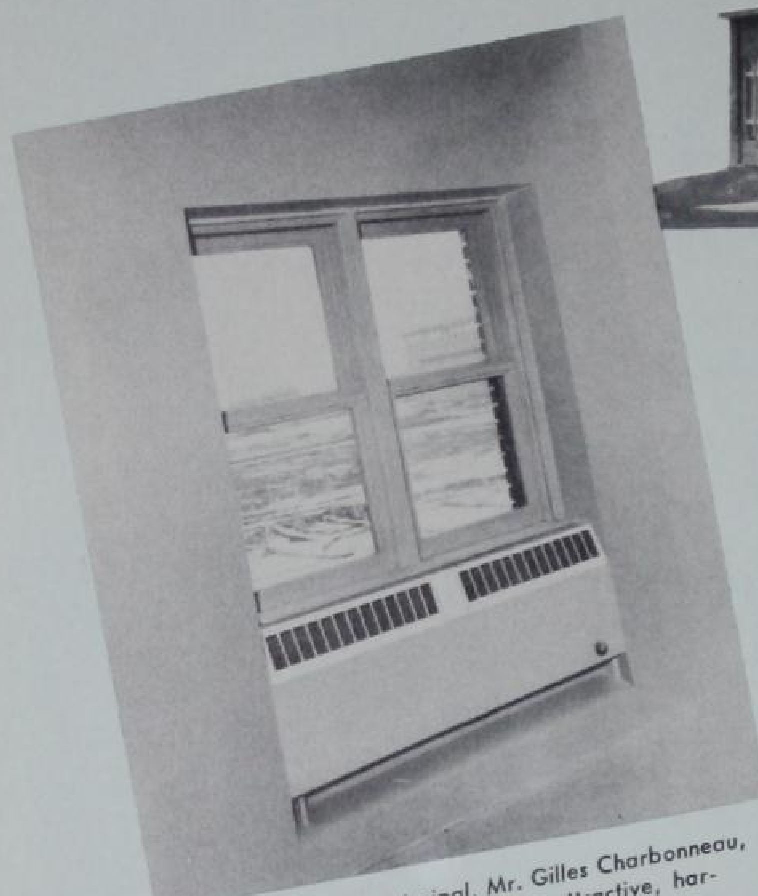
The Walvector system controlled by Sylphon regulator valves maintains classroom temperature within 2 degrees variation despite wide changes outside.

Long corridors like this at Granby offer difficult problems in heating which these Walvector multiple units solve completely.

...his type of heating for schools, see "The Heating ... A.Sc., Consulting Engineer, in the Journal of the

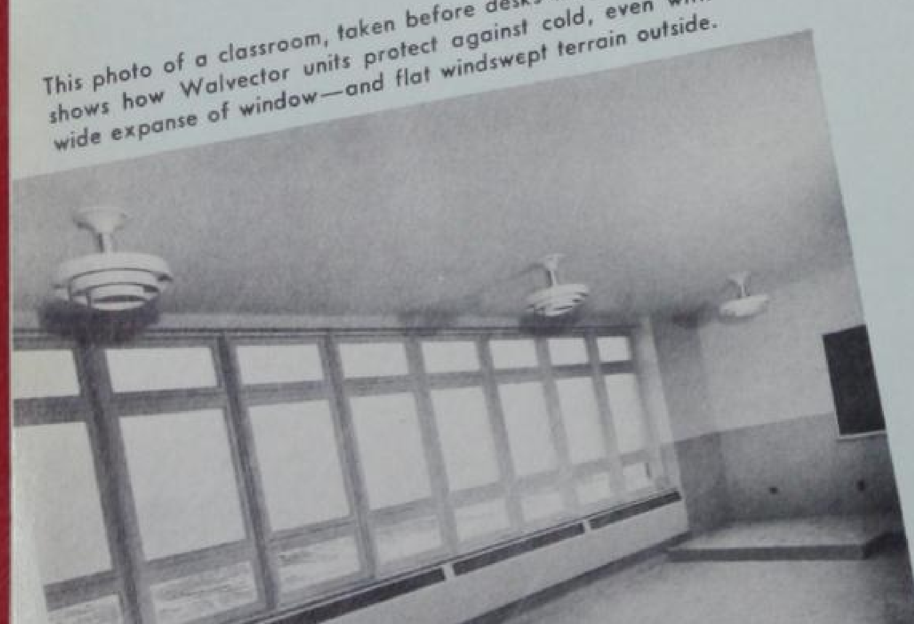
...and in ST. JOHNS, Que.

Architects: R. Dufresne, Montreal and Hull.
Consulting Engineers: Tasse, Sarrault & Assoc., Montreal and Quebec.
General Contractors: Jean Paul Trahan, St. Jean.
Heating Contractors: Industrial Plumbing & Heating Company Limited, Montreal.



The office of the Principal, Mr. Gilles Charbonneau, is adequately heated by this attractive, harmonious, recessed Walvector unit.

This photo of a classroom, taken before desks were installed, shows how Walvector units protect against cold, even with wide expanse of window—and flat windswept terrain outside.



ARTS & CRAFTS SCHOOL of ST. JEAN

Again a Complex Problem:

This new school to be operated by the Provincial Department o Youth and Welfare (Hon. Paul Sauvé, Minister), called for a heating system of great flexibility as well as dependability. The building which is much more extensive than the photograph shows, is locatec on a flat terrain of open fields and recreational grounds—subjectec on four sides to driving winds in winter.

Various Sizes of Rooms:

Within the handsome structure are offices, classrooms, and work shops of many different sizes, with varying proportions of outsid wall and window exposures. In the huge shop wing (at the rear i the picture) there are great areas to be heated—the electrica shop for instance, is 72 feet long by 35 feet wide. Obviously th heating system must have units which could be adapted to thes varied demands.

Walvectors Were the Answer:

The great flexibility of Webster Walvector Tru-Perimeter Heatin supplied the answer to this complex demand. From the single re cessed unit, out of the way, under the window of Principal Gill Charbonneau's private office, to the extended multiple units alor the outside work-shop walls, each different specific heating requir ment of this fine school has been adequately and dependably m with an attractive, efficient Walvector installation.

ANNOUNCING

Webster Tru-Perimeter Expansion Joints in ¾, 1 and 1¼ inch sizes

The new Webster Tru-Perimeter Expansion Joints are the latest addition to the group of Webster Specialties for forced circulation hot water heating. Specify and use also:

- Webster Pressure Relief Valve, capacity 776,000 BTU, Approved by A.S.M.E. and National Board of Boiler and Pressure Vessel Inspectors
- Webster Pressure Reducing Valve with built-in bypass
- Webster Return Header and Purge and Balance Valves
- Webster Bypass Valves
- Webster CF-3 Control for Hot Water Heating

Whether your requirements are for hot water or steam heating you can specify and use Webster equipment.

Now, there is an Expansion Joint designed to meet the specific requirements of Tru-Perimeter Forced Hot Water Heating; designed to be completely concealed within the enclosure of Webster Baseboard Heating or Webster Walvector; designed to provide *double-protection* against the possibility of leakage.

These new Webster Tru-Perimeter Expansion Joints provide for one-half inch movement, adequate to meet all requirements. They are made with a *big* brass bellows for *little* travel . . . Objective — long, trouble-free service. Double-protection against the extremely remote contingency of bellows failure is provided by two generously sized reinforcements of layer-wound fibre packing, a material that will expand if and when moisture should reach it. Made throughout of non-corrosive, seamless brass tubing, with plain male ends for sweat fittings.

Webster
TRU-PERIMETER FORCED HOT WATER
BASEBOARD HEATING

BULLETIN B-1620

CONTINUED ON BACK PAGE

WEBSTER TRU-PERIMETER EXPANSION JOINTS

Webster Tru-Perimeter Expansion Joints have been designed especially for use in Webster Baseboard Heating and other Webster Tru-Perimeter installations using Webster Walvector. Made in ¾, 1 and 1¼ inch sizes, they are designed for installation between heating elements and set behind the Webster Baseboard or Walvector enclosure, thereby being completely concealed.

Fig. 1. Webster Tru-Perimeter Expansion Joint Showing Name Plate. Made in ¾, 1 and 1¼ inch sizes.

Material and Construction

Webster Tru-Perimeter Expansion Joints are made entirely of non-corrosive materials. Seamless brass tubing is used together with greatly oversized seamless brass bellows. Travel is limited to ½ inch. While the probability of bellows failure is remote, double protection has been provided by use of two generously sized reinforcements of fiber packing, one at each side. In the event that moisture should reach the fiber packing it will expand and thus prevent flooding.

Ends are plain, sized for normal sweat fitting connections.

TABLE 1—Webster Tru-Perimeter Expansion Joint Dimensions—See Fig. 2

A	B	C	D
¾	6½	7	1¾
1	6½	7	2¼
1¼	6½	7	2¼

Dimension "A" is nominal tube size. All dimensions are in inches and subject to slight variations. Joints must be installed at normal length "C".

Installation

Expansion requirements are indicated by the figures in Table 2. Ordinarily it is desirable to install one expansion joint in the center of each straight run of 25 feet or more in length. Install joint at normal length (C) as given in Table 1. For runs of 50 feet or more it may be desirable to provide an anchor point in the center of the run with expansion joints at both ends. In large installations expansion joints can frequently be located in closets between rooms.

Webster Tru-Perimeter Expansion Joints are designed exclusively for service in hot water heating. They are suitable for working pressures up to 45 lbs. per sq. ft.

Suggested Specifications

Install where shown on plans or where required to meet expansion requirements, Webster Tru-Perimeter Expansion Joints of bellows construction with hard copper tubing and heavy brass shell incorporating supplementary protection with fiber packing which will expand in the event of bellows leakage and seal the ends of the casing.

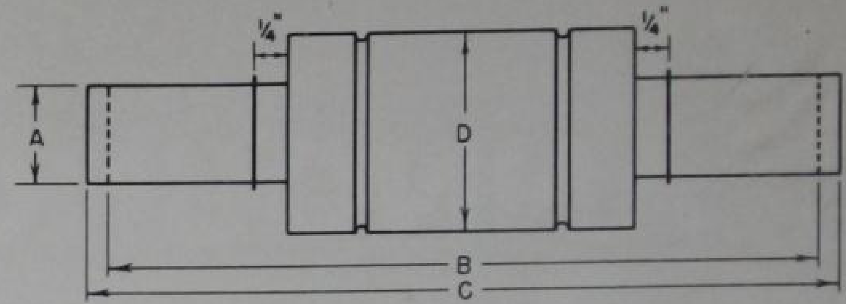


Fig. 2. Webster Tru-Perimeter Expansion Joint—Dimension Drawing.

TABLE 2—Expansion of Copper Tubing in Perimeter Heating

Based on 60°F Initial Water Temperature. Figures in Column 2 allow for ⅛" expansion at each end of straight run plus the ½" expansion provided by the Webster Expansion Joint.

Final Water Temperature °F	Maximum Lineal Feet for one Expansion Joint with joint in center of length
100	168
110	134
120	112
130	96
140	84
150	75
160	67
170	61
180	56
190	52
200	48
210	45

Packing and Shipping

Each Webster Tru-Perimeter Expansion Joint is packed in a separate cylindrical cardboard carton. Identifying label shown in Figure 1 appears on both the joint and on the outside of the tubular cardboard carton which is also stamped to indicate the size of the joint.

Guarantee

Webster Tru-Perimeter Expansion Joints are guaranteed to be free from original defect in material and workmanship under normal circumstances and the Company will furnish without charge new parts in exchange for any which may be returned within one year after date of shipment from our factories, provided transportation charges are prepaid to the Company at Camden, N. J., and which upon examination shall disclose to the satisfaction of the Company, original defects.

Inquiries and Quotations

Webster representatives will gladly cooperate to assure the success of installations of Webster Equipment. Request for further information should be addressed either to the Home Office at Camden, N. J., or to the office of the nearest Webster representative. Quotations and delivery estimates will be supplied promptly by the Webster representative. Consult your local telephone book or write us at Camden for his address.

To protect ourselves in our constant endeavor to make Webster Systems of Equipment even better, we reserve the right to change specifications and prices without notice.

WARREN WEBSTER & COMPANY

Representatives in Principal Cities • Established 1888

CAMDEN 5, NEW JERSEY

CABLE ADDRESS: Delphic

Darling Brothers, Ltd., P. O. Box 187, Montreal, Canada

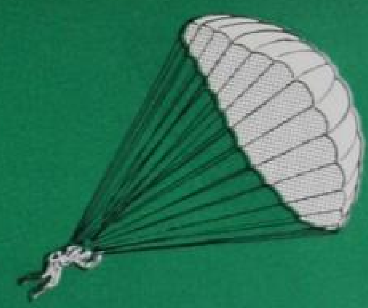
Form C-705—LR—Apr. 1954 5M

Printed in U.S.A.

WEBSTER BOILER PROTECTOR

for low pressure heating boilers

Listed by the National Bureau of Casualty and Surety Underwriters, Boiler and Machinery Division, as acceptable equipment on insured boilers.



To the cautious pilot, to the careful engineer, janitor or home owner, an *accident can happen*—perhaps only once—but that possibility is enough to warrant the most dependable safety device. . . . Every low pressure boiler is subject to the danger of accidental low water. Guard against this source of annoyance and expense with the Webster Boiler Protector.

Many low-pressure heating boilers are put out of service each year because of cracked or burned out sections. Boiler failure has become greater with increased use of automatic heating devices and complicated mechanical apparatus. Reliable protection is essential, particularly with gas and oil burners, mechanical stokers, vacuum pumps—automatic equipment of any kind. It is almost equally essential where boilers are operated by hand—wherever there is a possibility of carelessness or lack of regular attention.

Why Boilers Fail

Boiler sections may crack or break as a result of improper introduction of fresh water or sudden return of water of condensation from the heating system when water in the boiler is at a dangerously low level. Failure to maintain adequate water level is usually due to the following contributory conditions:

1. CARELESSNESS — Lack of minimum operating attention; dirt in piping connections.
2. PRIMING—Improper piping, fluctuating pressures or failure to provide thoroughly clean boiler and system.
3. FAILURE of automatic devices.

How to Prevent Boiler Breakage

The Webster Boiler Protector is designed to prevent the boiler water level from dropping below the danger line. The Protector is so installed that its operating level is 1″ above the bottom of the water gauge glass of the boiler. Should the water line of the boiler drop to the *Protector operating level,* the Protector automatically and adequately supplies water to the boiler and thus prevents damage. Fresh water is fed to the boiler through the regular return header and mixes with heated water already in the boiler. Danger of breakage caused by sudden introduction of cool water on exposed boiler sections is minimized.

Materials Used in Manufacture

All bearings, spindles, pins, valve parts and other interior elements are made of non-corrosive metals, specially selected for the service demanded of them. The water valve body is of steam brass. A seamless copper float actuates a Monel Metal pilot valve of the cone type using a sharp-edged Monel Metal seat.

Cover and float casing are made of cast iron. After machining, they are Parkerized, a process which provides a rust-resisting finish base. Interior of these parts is then painted with Asphaltum paint to further lessen deterioration due to rust. Synthetic gaskets are used between the various parts.

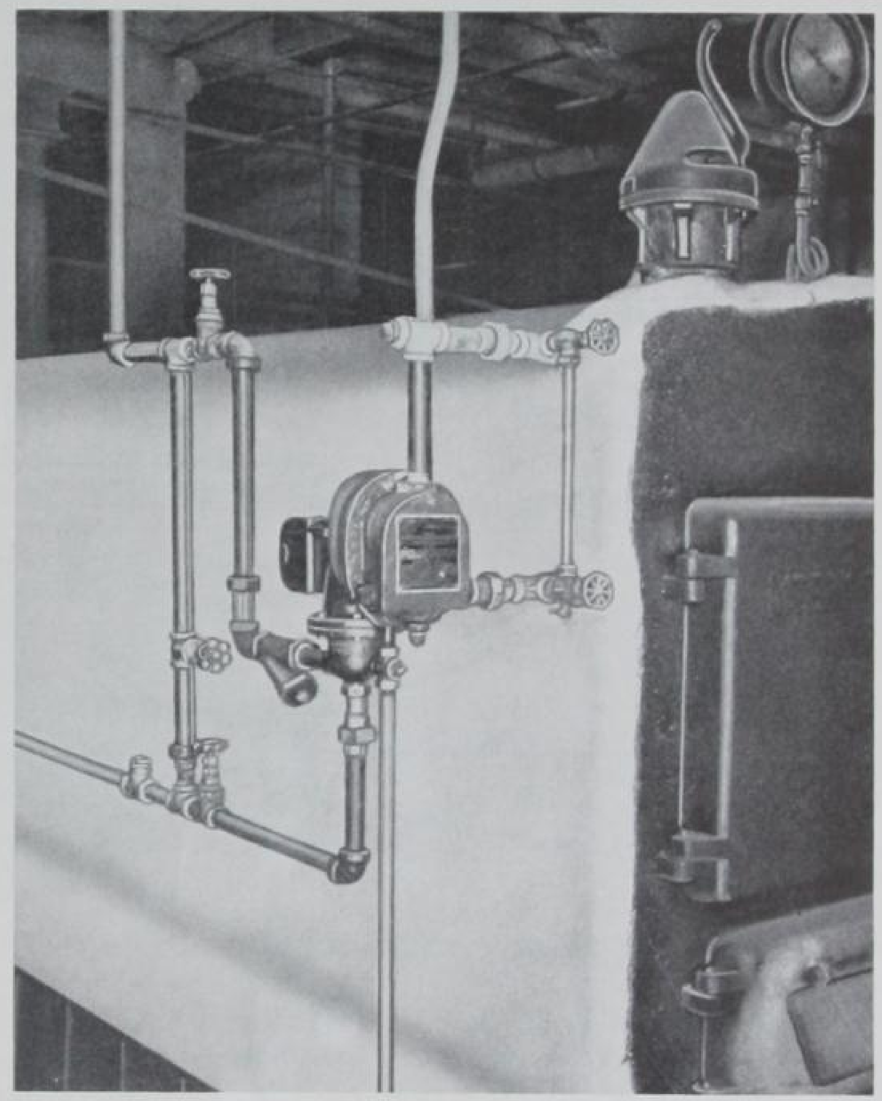


Fig. 1. Webster Boiler Protector installed on low pressure, cast iron boiler.

The water valve utilizes the well-known Sylphon bellows and seats on a Jenkins composition disc specially treated to minimize adherence of disc to seat. Standard equipment includes a special Webster Dirt Strainer with extra heavy brass nipple for insertion in city water supply and a brass drain cock with iron nipple for testing purposes.

The small bellows which makes possible a packless connection between cut-out switch mechanism and the float chamber is strong enough to withstand an external pressure many times that encountered in low-pressure heating boilers.

Bulletin B-727F

Look Inside the Boiler Protector

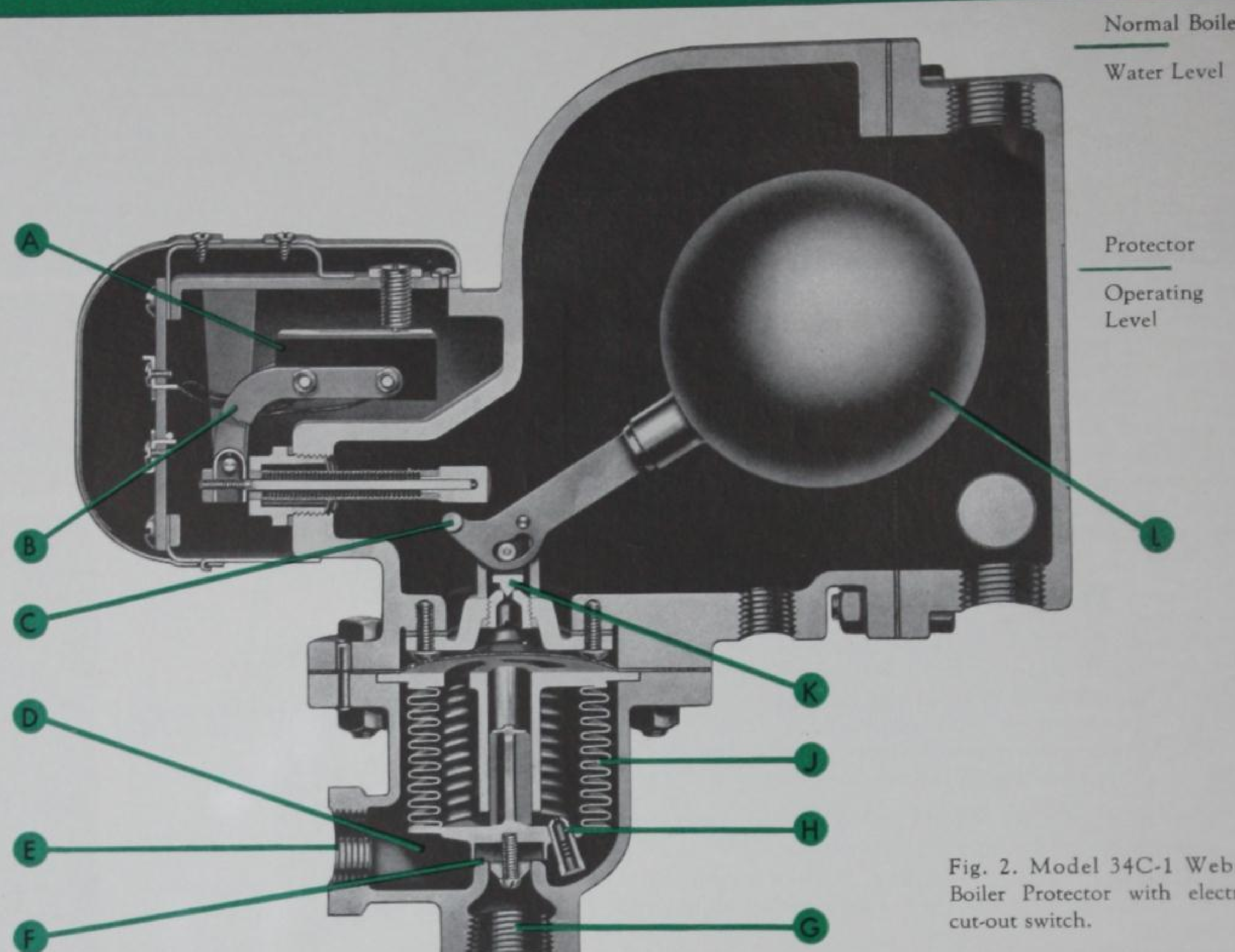


Fig. 2. Model 34C-1 Webster Boiler Protector with electrical cut-out switch.

How It Works

When water in boiler is at normal level, float (L) is submerged and its buoyancy is exerted through a leverage to hold the small, cone-pointed Monel Metal valve (K) on its square-edged seat. As long as boiler water level does not get below *Protector operating level,* Boiler Protector remains inactive. City water pressure is supplied through protecting Dirt Strainer into connection (E), completely filling chamber (D) and holding water valve (F) on its seat. The inside of Sylphon bellows (J) is filled with water through intake orifice (H) which is protected by a screen. Slots in screen are narrower than orifice, so that any particle of foreign matter that will pass through slots will pass through orifice also.

If water level drops below *Protector operating level,* float (L) drops and opens valve (K). Water flows through valve (K) because of difference between low boiler pressure and higher city water pressure inside bellows. The opening of valve (K) is larger than the opening through bellows intake orifice (H); consequently, water runs out of inside of Sylphon bellows more rapidly than it flows into bellows. This causes an almost instantaneous pressure difference between inside of bellows and outside. This difference in pressure, exerted over lower surface of bellows, causes immediate wide opening of water valve, allowing FULL FLOW OF WATER through connection (G) to boiler.

The entire operation occurs in just a few seconds, with net change in water line of ½″ or less. As soon as water line has been restored, float (L) rises, valve (K) closes. Pressure inside and outside the bellows is equalized and spring of bellows plus difference between city water pressure and boiler pressure closes water valve.

If water continues to fall, the float lever extension (C) rises and trips cut-out switch (A) through mechanism (B). Switch opens electrical circuit and burner or stoker stops. A bell or buzzer and lamp can also be wired to the switch to indicate at a remote station that the burner or stoker has stopped. If water line rises, switch is again tripped and circuit is closed to start burner or stoker. In most cases Protector will maintain water line at its operating level so that the cut-out switch is not tripped and burner or stoker continues to operate.

With hand-fired boilers where the cut-out feature is not needed, the switch may be used with a lamp and bell or buzzer to signal operator that boiler water line has fallen.

Reliable Action

The Webster Boiler Protector is an hydraulically operated (pressure-actuated) valve embodying a powerful operating mechanism. The main water supply valve is not directly dependent upon the weight or buoyancy of a float to operate it—instead the float is used only to operate a small pilot valve. The lifting or operating forces on the main valve are the result of hydraulic power and the difference in area of the bellows diaphragm and that of the main valve. This difference is so great that an initial water pressure of only 50 lbs. per sq. in. will produce a lifting force of 150 lbs. per sq. in. on the main valve of the Boiler Protector.

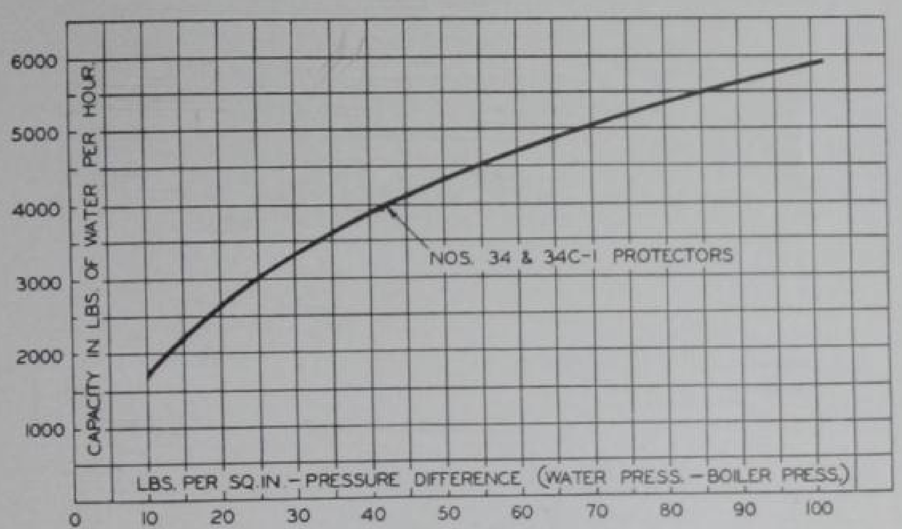


Fig. 3. *Instantly developed maximum capacity* is a feature of Webster Boiler Protectors. When protection is needed, your boiler is safeguarded by a full, free flow of water from the main. The curve shown above gives rated capacities in pounds of water per hour.

Separate Water Inlet Valve

The water inlet valve and operating mechanism are in a chamber separate from the float chamber. The low temperature prevailing in this chamber (about 115° F.) reduces the likelihood of precipitation of scale-forming matter. This is further minimized by the fact that a very small volume of water passes directly through the operating mechanism.

Inspection and Cleaning

Webster Boiler Protectors have been so designed that the entire interior mechanism can be removed for inspection and cleaning without disturbing piping connections. It is only necessary to lower the water line of the boiler below the edge of the water inlet valve chamber and remove a few bolts holding the various parts together.

Repairs and Replacements

Being sturdily made, Webster Boiler Protectors will give long service without the necessity for repairs and replacements, particularly if systematic procedures are employed for regular inspection and cleaning.

When repairs do become necessary such parts as gaskets, valve discs, electric cut-out switch assemblies and switch lever guide assemblies can be readily replaced in the field.

For all other repairs and replacements best procedure is to order a replacement unit. These replacement units are thoroughly factory re-built units. A liberal credit is allowed on the return of the unit removed.

Test Connection Provided

Protective or safety devices for maximum effectiveness should be subjected to regular inspection and test. In order to facilitate this, a separate blow-off or test connection has been provided to the float chamber. A drain cock and short iron nipple are screwed into this connection as standard equipment on all Boiler Protectors. It is recommended that, at the start of each heating season and at least monthly thereafter, an operating test be carried out. Full instructions are given on the name plate of each Protector and in Installation and Maintenance Instructions contained in an envelope wired to the Protector when it is shipped from the factory. Installation and test connection should be made exactly as shown in the Webster Service Bulletin which is in agreement with the recommendations of the National Bureau of Casualty and Surety Underwriters, Boiler and Machinery Division.

Application Data

The Webster Boiler Protector is applicable to almost all sizes and types of low-pressure heating boilers, cast iron or steel, where the maximum boiler pressure will not exceed 15 lbs. per sq. in. The minimum city water main pressure must not be less than 25 lbs. per sq. in.; the maximum should not exceed 150 lbs. per sq. in. A minimum pressure difference of 10 lbs. between water supply line and boiler pressure is required for the Boiler Protector to operate. Minimum water pressure must be available directly ahead of Protector as considerable drop in pressure may occur in line from city main.

Webster Boiler Protectors are made in two models: No. 34 and No. 34C-1, the latter furnished with an electrical cut-out switch. The standard cut-out switch furnished is single pole, double throw and is electrically

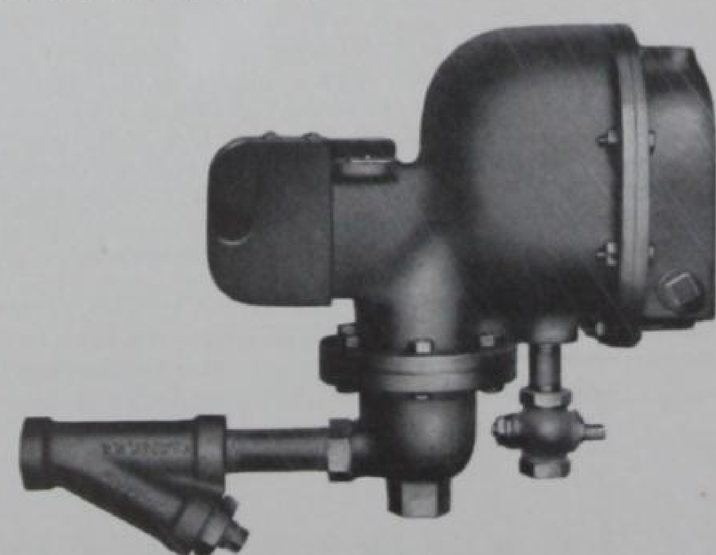


Fig. 4. Webster Boiler Protector Model 34C-1 illustrated has electrical cut-out for automatic heat. Model 34 is for hand-fired boilers.

rated for 125-250 volts, alternating current, ½ horsepower motor. Special equipment for other characteristics can be furnished at additional cost. Manufacturers of oil and gas burners, stokers, burner-boilers, et cetera, furnish wiring diagrams for application of cut-out switches to their equipment.

Webster Boiler Protectors are shipped in a strong box completely assembled with long brass nipple and with test cock and short iron nipple. The special Webster Dirt Strainer is loose in the box and must be assembled at the boiler by the installer.

Webster Service Bulletin S-680 giving instructions for installation is included with each Protector when shipped. Additional copies of this bulletin will be furnished upon request to the Company at Camden, New Jersey, or to its nearest Representative.

Fig. 6. A reproduction of the nameplate on each Webster Boiler Protector. Note that it gives instructions for installation, test and maintenance.

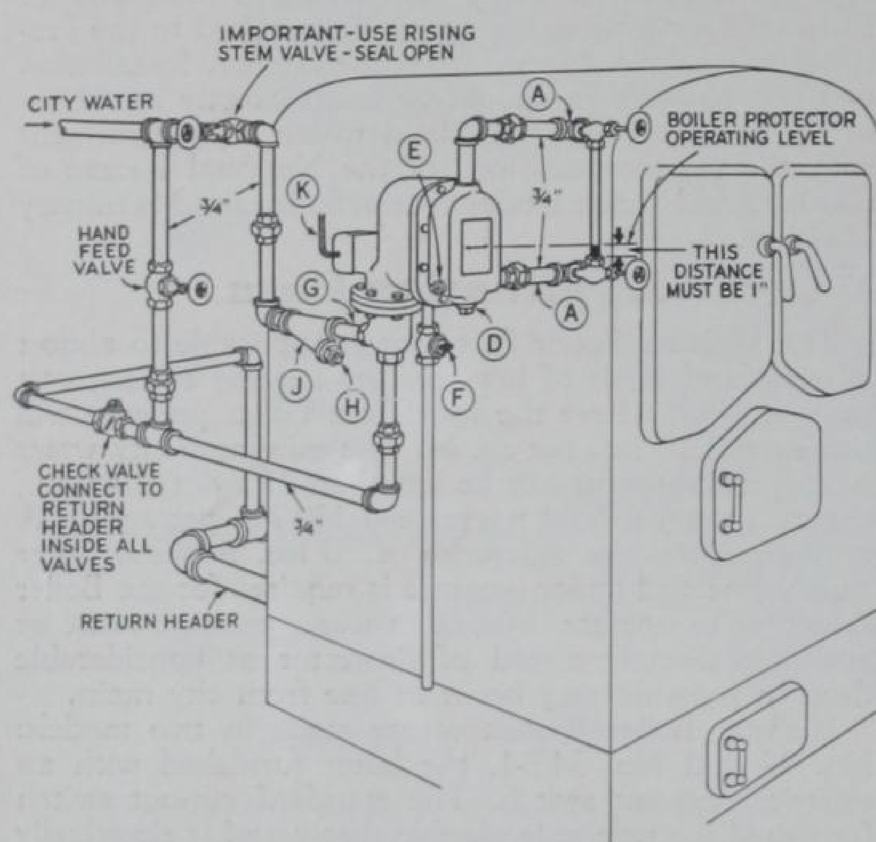


Fig. 5. Installation and Maintenance Diagram for Webster Boiler Protector. Pipe connections (A) above and below water line are to be the size of water column or tapping in boiler but not less than 3/4". Remove plugs (D, E) and clean out regularly at least twice a year. Blow down cock (F) is used for testing. Use brass nipple (G) only as shipped with Protector. Remove plug and strainer basket (H) and clean regularly at least twice a year. Webster "78" Strainer (J) is shipped with Protector. Electrical connections (K) are found on Model 34C-1 Protector only. Be sure to make a clean installation. See that water supply pipe is thoroughly flushed and that there are no chips between Strainer and Boiler Protector.

WARRANTY

We warrant apparatus manufactured by us to be free from defects in material and workmanship under normal use and service; our obligation under this warranty being limited to making good at our factory any part or parts thereof which shall within one year after delivery of such apparatus to the original purchaser, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on our part, and we neither assume nor authorize any other person to assume for us any other liability in connection with the sale of our apparatus.

This warranty does not cover any labor charges for replacement of parts, adjustments, repairs, or any other work done. The Company assumes no responsibility for consequential damages of any kind, and the purchaser or user, by acceptance of this equipment, assumes all responsibility for the consequences of its use or misuse.

This warranty shall not apply to any apparatus which shall have been repaired or altered outside of our factory in any way so as, in our judgment, to affect its stability, nor which has been subject to misuse, negligence or pressure in excess of stated limits.

WARREN WEBSTER & COMPANY

17TH AND FEDERAL STREETS, CAMDEN, N. J.

Representatives in Principal U. S. Cities. In Canada: DARLING BROTHERS, Ltd., P. O. Box 187, MONTREAL

Form No. C-607B (11-53-10M) J-LR

Printed in U.S.A.

Webster

WALVECTOR

REG. U. S. PAT. OFF.

RADIATION

DESCRIPTIONS • DIMENSIONS

I-B-R

Reg. U. S. Pat. Off.

RATINGS

for steam and hot water heating

BULLETIN B-1551C

WARREN WEBSTER & COMPANY

ESTABLISHED 1888

CAMDEN 5, NEW JERSEY • Representatives in Principal Cities

Webster Tru-Perimeter Heating

WEBSTER "Tru-Perimeter" Heating uses Webster Walvector, Webster Baseboard, or a combination of both, to replace the heat at the perimeter where heat loss occurs. Heating elements are mounted close to the floor along outside walls, spreading the heat the entire length of the exposed walls. Webster "Tru-Perimeter" Heating warms the air within a room, warms the floors, and warms the inside surface of outside walls where a normal coolness occurs during the winter months. Gently moving warmed air is drawn to floor level and across the floor into the inlet opening of the radiation. Radiant heat rays strike the floor along the full length of the exposed wall. Floors are warm and comfortable even with slab floor construction. Webster "Tru-Perimeter" Heating results are obtainable with either forced hot water or Moderator controlled low-pressure steam heating.

Webster Walvector Radiation

WEBSTER Walvector is a thoroughly proved idea in wall radiation which is daily solving engineers' heating design problems, both in new buildings and in modernization. Webster Walvector is an elongated convector designed for mounting along the wall, close to the floor line and under windows. It combines an attractive steel enclosure and a highly efficient non-ferrous heating surface, together with appropriate mounting angles, braces, end plates, connecting trims and heating element hangers. Used together, these components provide a completed installation like that illustrated in Fig. 1. Or, they may be arranged in separate units similar to conventional convectors.

Heating Element

The heating element used in all Webster Walvector installations is the familiar extended fin surface illustrated in Fig. 2. It is made with copper tubing and aluminum fins in 3″ and 4″ fin sizes. Tubing is specially annealed copper, good for saturated steam pressures up to 100 lbs. per sq. in. and temperatures up to 330° F. Tubing for 3″ size is 1″ nominal (1⅛″ outside diameter) with .035″ wall thickness; for 4″ size tubing is 1¼″ nominal (1⅜″ outside diameter) with .042″ wall thickness. Complete assembly is coated with black paint.

Standard production is with plain ends as illustrated in Fig. 2 for sweat connections. On special order, it may be obtained with threaded brass connections, one end male, other end female, as shown in Figure 3. These connections are 1″ I.P.S. for 3″ size and 1¼″ I.P.S. for 4″ size.

Fins are square with rounded corners, liberally ribbed for strength and stamped from .020″ aluminum. Spacing flange is stamped integral and expanded with the copper tube to form a solid, permanent thermal bond. Complete information as to sizes, dimensions and ratings for this heating surface when used with or without the customary Walvector enclosure is given in the pages that follow.

Fig. 2. Webster Walvector Extended Surface Heating Element (shown without enclosure) with plain ends for sweat fittings. For table of sizes see page 11.

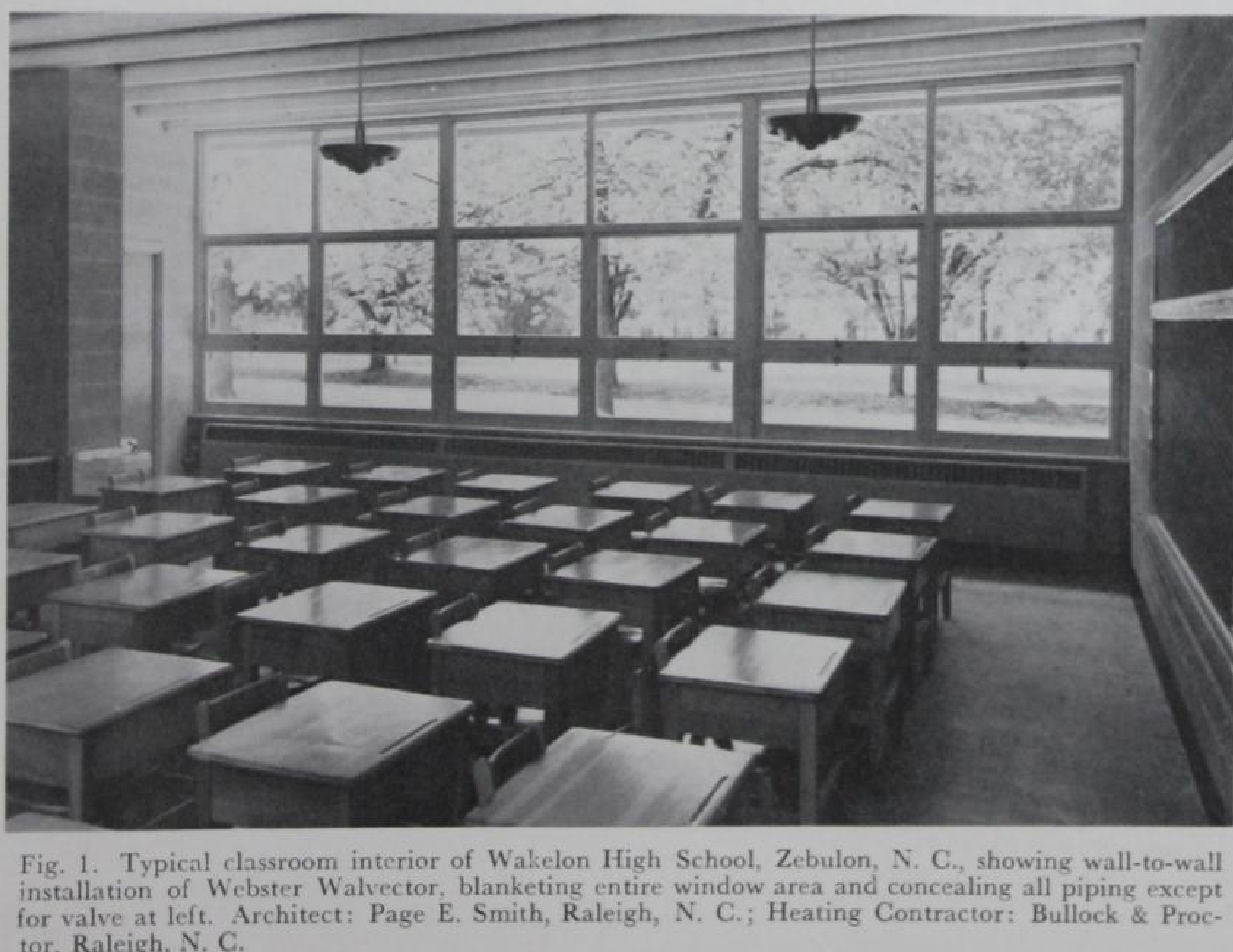


Fig. 1. Typical classroom interior of Wakelon High School, Zebulon, N. C., showing wall-to-wall installation of Webster Walvector, blanketing entire window area and concealing all piping except for valve at left. Architect: Page E. Smith, Raleigh, N. C.; Heating Contractor: Bullock & Proctor, Raleigh, N. C.

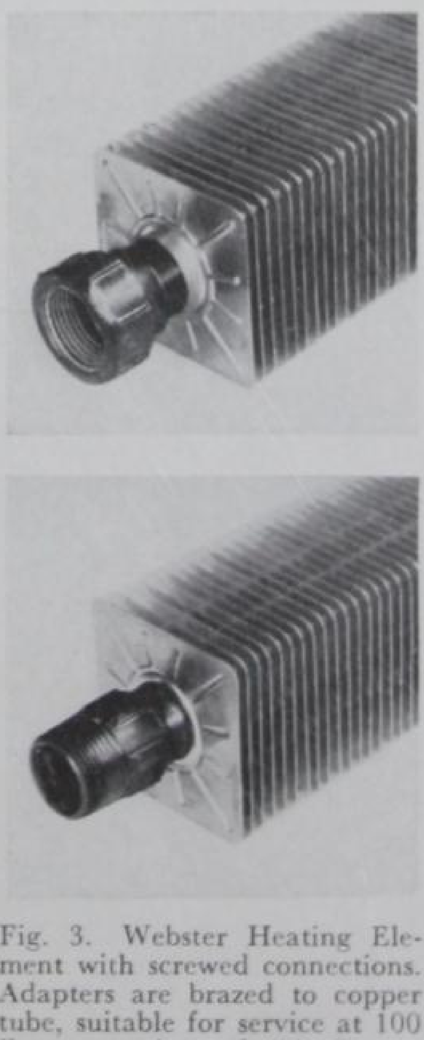


Fig. 3. Webster Heating Element with screwed connections. Adapters are brazed to copper tube, suitable for service at 100 lbs. per sq. in. and 330° F.

Walvector Components

Webster Walvector is a complete "package" incorporating the heating element and all components needed for mounting and enclosure. Each package includes those items required from the following list of components:

a. Heating Element
b. Mounting Angle with Gasket
c. Enclosure
d. Enclosure End Plates
e. Enclosure Trim Pieces
f. Enclosure Corner Pieces
g. Lower Braces
h. Heating Element Hangers, single row
i. Heating Element Hangers, double row
j. Drive Screws
k. Damper (optional—available at extra cost)
l. Stiffening Supports (see page 4 and Fig. 8)

The manner in which these components are combined will be evident by examination of the exploded view in Figs. 4 and 7.

Choice of Enclosures

Webster Walvector is available with cabinet type enclosures having grilles in sloping front, or with plain cover with a solid front and perforated top.

The cabinet type enclosure is available in nominal lengths of 2 ft. to 7 ft., inclusive, in 1-ft. increments. Three different sizes provide four arrangements of heating element as follows:

(1) Single row, 3″ fin, in 11″ high enclosure providing a basic steam rating of 5.85 sq. ft. E.D.R. per lineal foot of heating element.

(2) Single row 4″ fin, in 12½″ high enclosure providing a basic steam rating of 8.25 sq. ft. E.D.R. per lineal foot of heating element.

(3) Single row, 4″ fin, in 20″ high enclosure providing a basic steam rating of 10.15 sq. in. E.D.R. per lineal foot of heating element.

(4) Double row, 4″ fin, in 20″ high enclosure providing a basic steam rating of 11.80 sq. ft. E.D.R. per lineal foot of heating element.

For design details and dimensions of above enclosures, see page 11.

Plain cover with solid front and perforated top is available in 2-ft. to 6-ft. lengths for 3″ fins, and 2-ft. to 8-ft. lengths for the 4″ fin. Increments for both sizes are 1 ft. Basic steam rating is 4.7 sq. ft. E.D.R. per lineal foot of heating element for the 3″ size and 6.9 sq. ft. E.D.R. for the 4″ size. Description and diagram of plain cover are shown on page 5.

Walvector enclosure and mounting angle are made of 18-gauge cold rolled steel and are finished in a baked-on gray prime coat.

Important Design Features

A special effort has been made to assure that the Webster Walvector Cabinet Type Enclosure meets Webster standards for clean heating. The unique sponge rubber gasket thoroughly seals the space between the enclosure and the wall, even if there are wall irregularities. This feature, together with the flat 2″ horizontal surface and the slope front with specially designed directional louvers, have the effect of throwing convected air flow well away from the wall.

Walvector hugs the wall, occupies no useful floor space and may be placed at any desired wall height. However, for best heating results, it is preferable to mount the Walvector 4″ above the floor line.

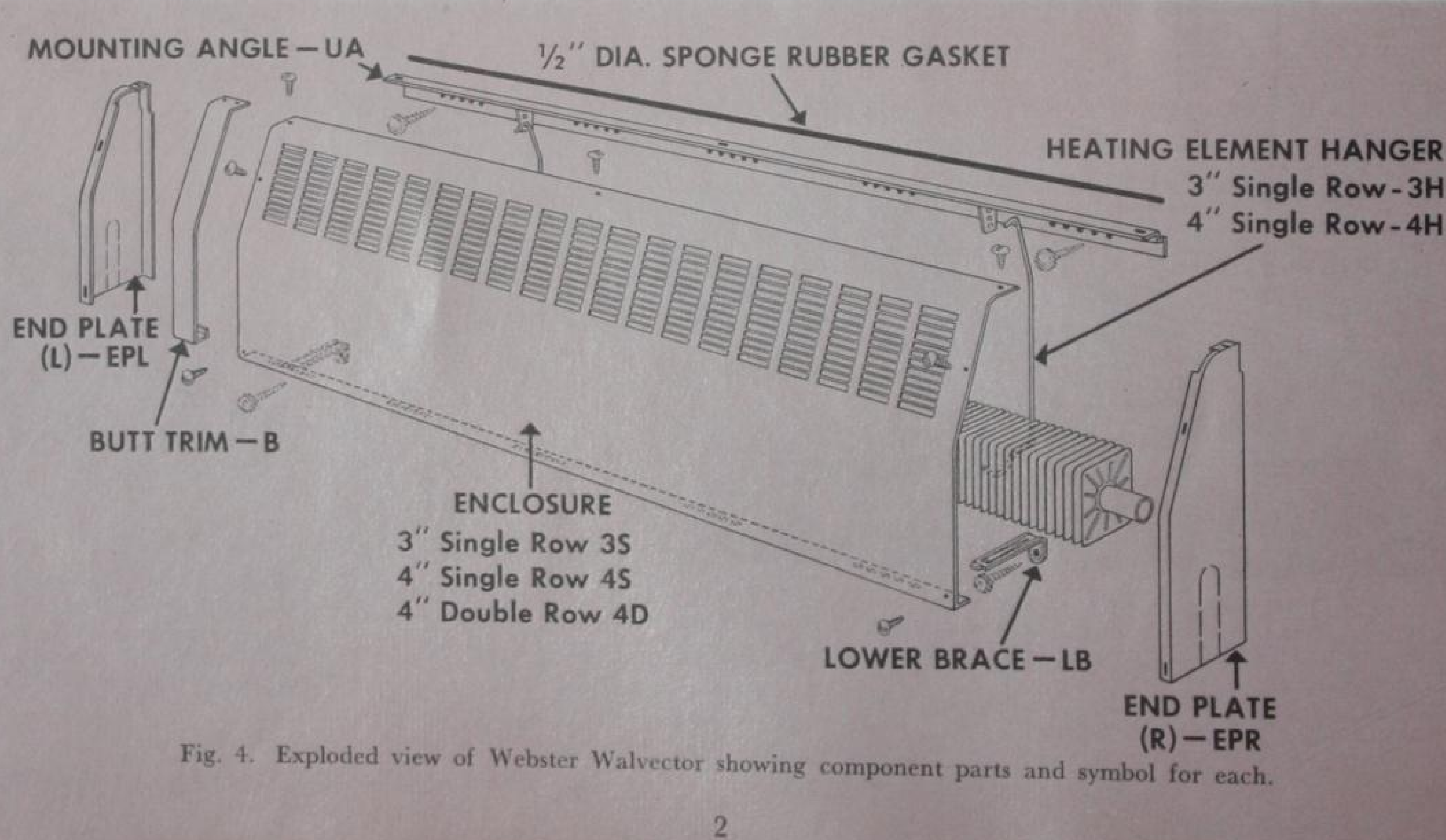


Fig. 4. Exploded view of Webster Walvector showing component parts and symbol for each.

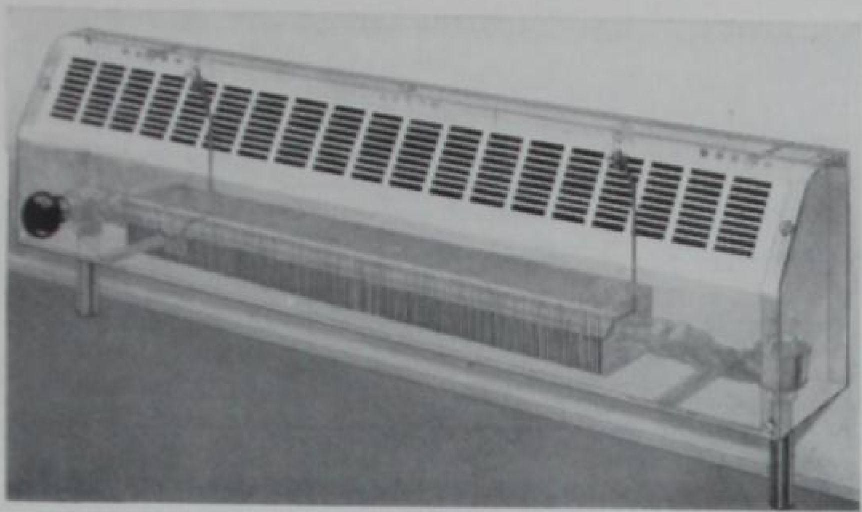


Fig. 5. Webster Walvector for steam heating installation in phantom view, 12½″ Enclosure and 4″ fin type Heating Element with adapter ends. Webster ¾″ Supply Valve, corner body type, at left, and Webster ½″ Radiator Trap with offset adapter at right.

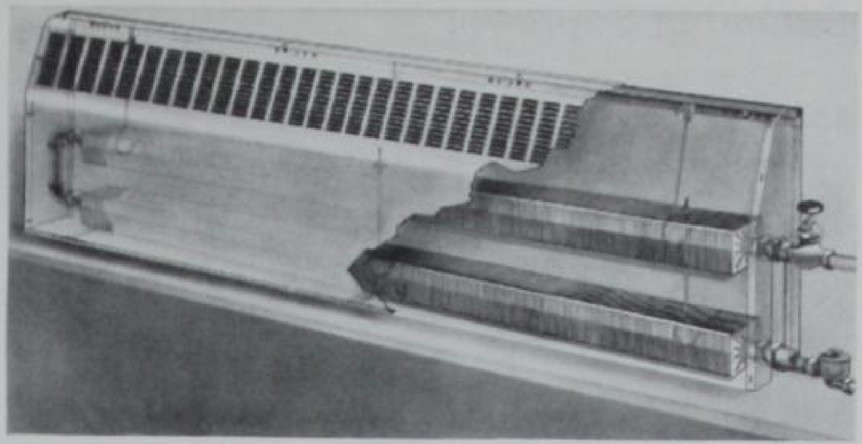


Fig. 6. Webster Walvector showing double tier of 4″ fin Heating Elements with adapter connections. Enclosure is 20″ high. Steam piping passes through knock-out in end piece of Enclosure—note Webster ¾″ Supply Valve, straightway body, and Webster ½″ Radiator Trap and Offset Adapter, both located outside Enclosure.

Installation Procedure

The advantages of Webster Walvector will become increasingly evident by examination of the installation procedure for Cabinet Type Enclosures.

After determination of the location of the Walvector, the 18-gauge pressed steel Mounting Angle is fastened to the wall in a level position. Angle is furnished in 2, 3, 4, 5, 6 and 7-foot lengths, corresponding to the enclosure lengths and provided with a ½″ round sponge rubber gasket fastened in place. Abundant spaced holes are provided in the face of the angle for lag screws for wall mounting, and slotted holes in the top of the angle for fastening the enclosure. Mounting Angles are further provided with gusset plates at intervals and each gusset plate is drilled with four holes for positioning the heavy wire Heating Element Hangers.

After installation of the Angle, Heating Element Hangers are placed in position and the heating element suspended from them. Pipe fitting can then proceed in the usual manner. After the piping has been completed, the enclosure front is fastened in place to the Mounting Angle. End Plates and Butt Trim Pieces installed where required. End Plates are left and right hand and provided with knock-outs for use when installation is of the type shown in Fig. 6. Finally, Lower Braces are placed in position and fastened to the wall with lag screws or other suitable means.

NOTE—This bulletin is not intended as an installation manual. In all cases, installation should be made in accordance with approved Webster Service, details which are available at the office of the nearest Webster Representative.

Walvector Damper

The Walvector Damper is formed of sheet steel, .025″ thick, with each edge turned for rigidity. In closed position (shown in the exploded drawing, Fig. 7), it stops the flow of air through the unit. Damper opens by turning the knob operator in a counter clockwise direction. The knob operated damper is a modulating type that regulates the amount of heat delivered.

The damper is factory assembled to enclosure with damper operator knob completely installed.

Dampers are available in same nominal lengths as enclosure from 2′ to 7′ inclusive.

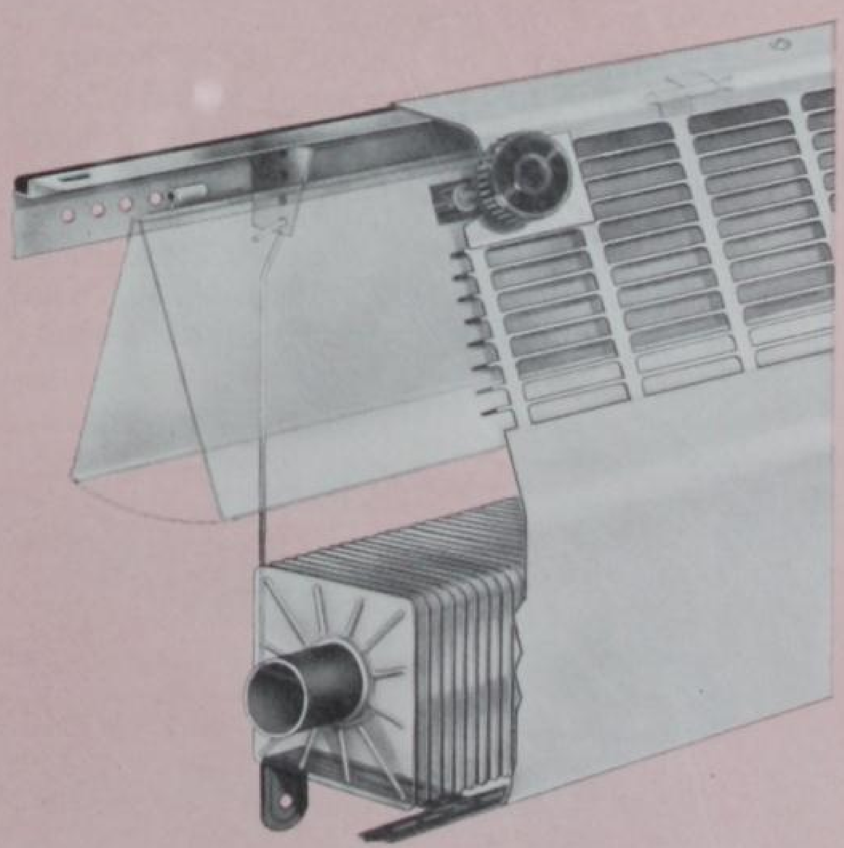
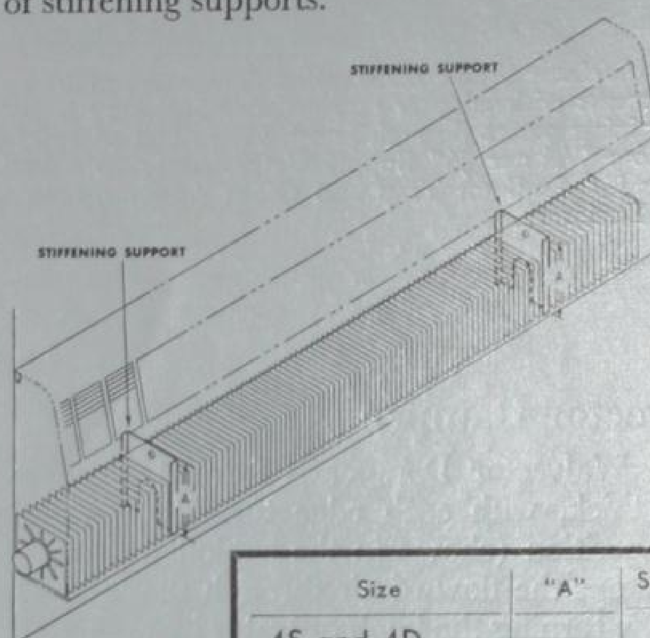


Fig. 7. Cutaway view showing knob operated Damper.

Stiffening Supports

Stiffening supports are available for 4″ single row and 4″ double row Walvector enclosure for applications such as schoolhouses where additional rigidity of enclosure may be desirable. The stiffening supports are held in place by heating elements. Spacing recommended is every 4 ft. on 4S (12½″) and every 3 ft. on 4T or 4D (20″) Walvector enclosure. Figure 8 shows stiffening support in place. Table below gives dimensions of stiffening supports.



Size	"A"	Symbol
4S and 4D—Walvector	5″	45S
4T—Walvector	11½″	411S

Fig. 8. Stiffening supports in place.

Plain Cover

A cover of No. 18-gauge pressed steel, having a solid front and perforated top, is available in lengths extending over all the fins of the heating element. Cover is finished with a baked-on prime coat. Perforations on top are approximately ⅝″ square, spaced 3/16″ apart and provide 64% open area, with the result that the cover reduces heating capacity of the unit only about 5%. Cover encloses front and top and provides a 1″ overhang in the back. It is hand pressed in position and is removable without tools.

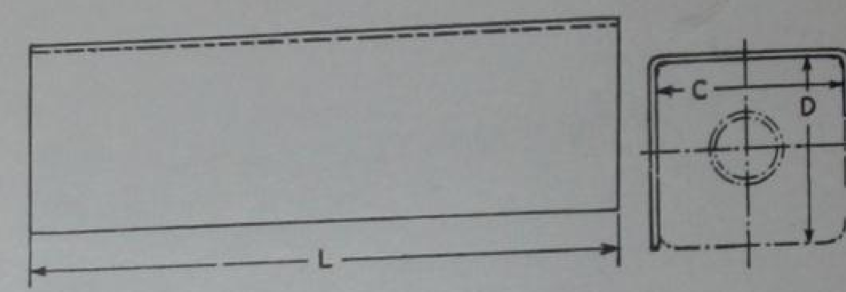


Fig. 10. Dimensions of plain cover, front view and end view.

Table I. Dimensions of Plain Cover for 3″ Webster Heating Element—Letters Refer to Figure 10

Symbol	Length L	C	D
3 G 2	2 ft.		
3 G 3	3 ft.		
3 G 4	4 ft.	3 1/32″	3″
3 G 5	5 ft.		
3 G 6	6 ft.		

Table II. Dimensions of Plain Cover for 4″ Webster Heating Element—Letters Refer to Figure 10

Symbol	Length L	C	D
4 G 2	2 ft.		
4 G 3	3 ft.		
4 G 4	4 ft.		
4 G 5	5 ft.	4 1/32″	4″
4 G 6	6 ft.		
4 G 8	8 ft.		

Bracket

For use with or without plain cover, a one-piece bracket is provided. Made of .072″ cold rolled steel, it is provided with an elongated hole for screw mounting and three small unit holes for vertical aligning. Hinge permits expansion and contraction. Bracket is notched to support tube between fins.

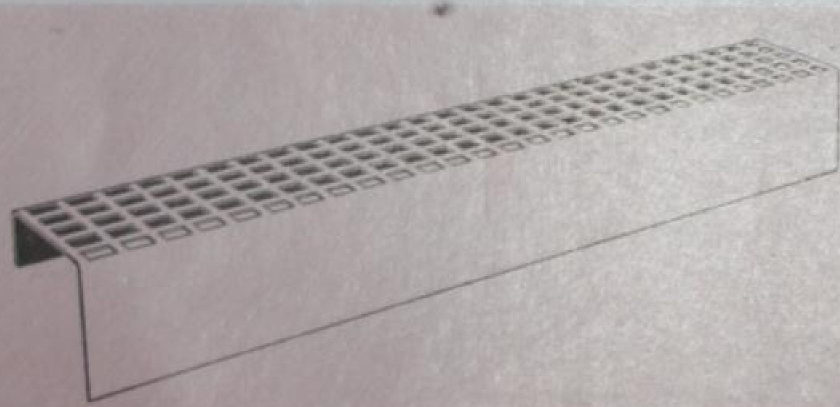


Fig. 9. Plain cover with solid front and perforated top, also available for Webster Heating Element.

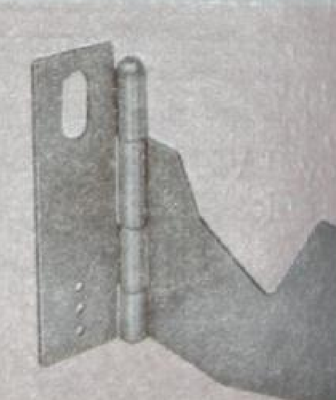


Fig. 11. One-piece bracket for Heating Element support.

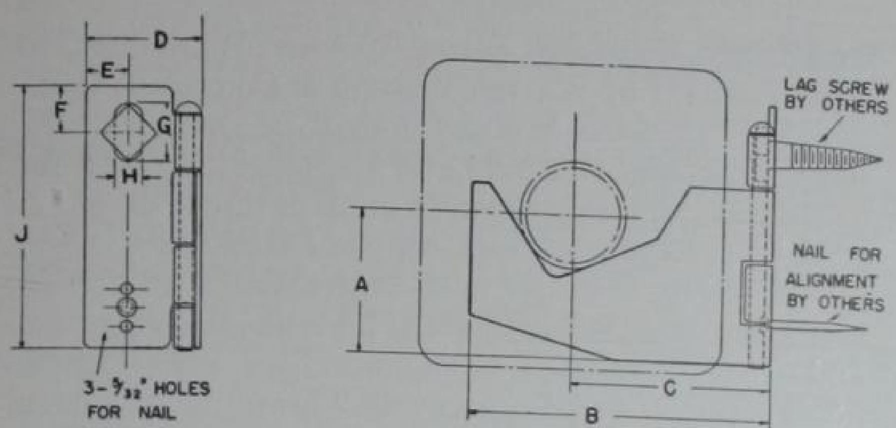


Fig. 12. Dimensions for Bracket shown in Fig. 11.

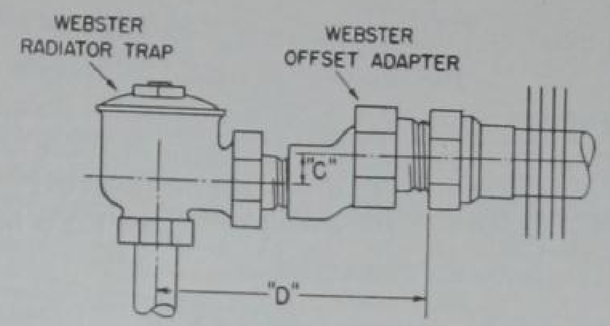


Fig. 14. Webster Offset Adapter (screwed connection). Return line (not shown) is same as in Fig. 15.

Table III. Dimensions of Wall Bracket for Plain Cover—Letters Refer to Figure 12

Symbol	A	B	C	D	E	F	G	H	J
3 BH	1 7/8"	3½"	2 3/16"	1½"	9/16"	5/8"	¾"	3/8"	3 7/16"
4 BH		4"	2 11/16"						

Space Brackets approximately 36" to 42".

Special Long Length Tube Orifices

These orifices have been developed particularly for use with Webster Walvector Radiation. They incorporate, in addition to the features of the standard tube orifice, spacing elements to assure the centering of the distributing tube within a lengthy heating element and distribution of steam through supplementary orifices drilled along the tube, as illustrated in Fig. 13. This development makes it possible to combine the advantages of Webster Moderator Control with use of modern Webster Walvector which effectively spreads the heat delivery over the entire exposed wall area.

Offset Adapter

The Webster Offset Adapter has been provided as a convenient and economical means of assuring complete drainage of water from the heating element. Available with sweat or screwed connections on radiator end.

Expansion

Piping connections to Webster Walvector must be installed so that it is free to expand and contract with changes of temperature without producing undue stresses on piping or equipment. Hangers in Walvector enclosure permit heating element to float, and expansion is absorbed in piping connections.

Where the Walvector Heating Element is used plain or with plain cover, hinged brackets should be used to permit expansion and contraction. Table IV covers the conditions allowable using hinge brackets.

Table IV. Allowable Expansion With Webster Heating Element

Gauge Pressure	5	10	25	50	75	100
Maximum Run	30′	28′	24′	21′	19′	18′

Note 1: Bracket can be used to accommodate approximately ½" expansion.
Note 2: Expansion must be measured from anchor point to most distant bracket. If anchor point is at center, the maximum run can be doubled.

Expansion Connections

Copper expands approximately 1¾ inches for each 100 feet of run, at 1 lb. gauge pressure and 215° F. temperature. When space conditions permit the customary swing joints in return piping may be used to compensate for this expansion.

In steam heating installations where swing joints are not used Webster Expansion Connectors may be employed. These are flexible tubes with standard screwed

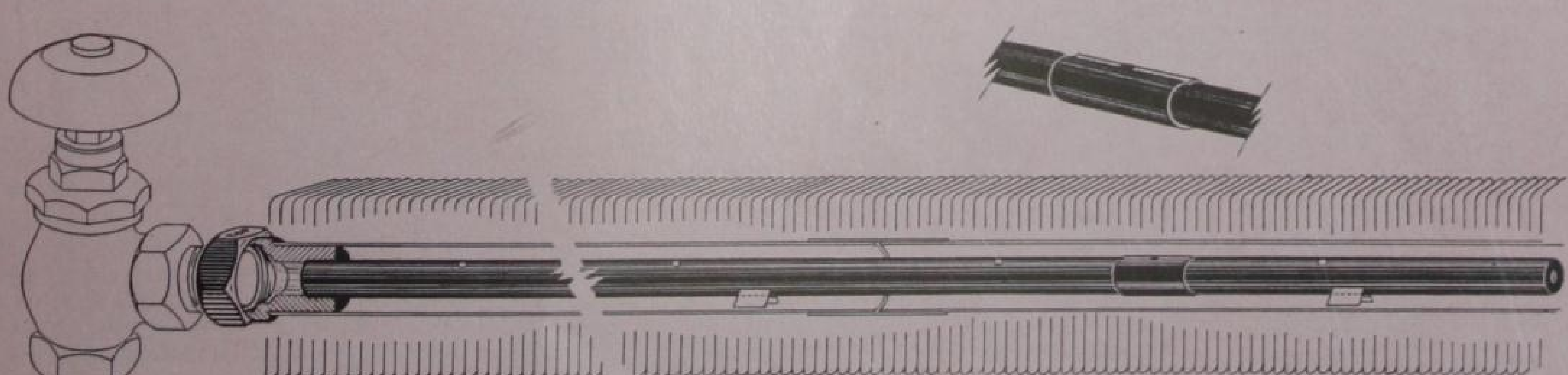


Fig. 13. Orifice Tube in Webster Walvector Heating Element.

connections, available in two sizes, ½″ x ½″ x 9″ and ¾″ x ¾″ x 9″. Installation is made as shown in Fig. 14. Webster Expansion Connectors are suitable for steam service up to 100 lbs. per square inch pressure.

For hot water installations Webster Tru-Perimeter Expansion Joints in 1″ and 1¼″ sizes may be used. Descriptive bulletin is available.

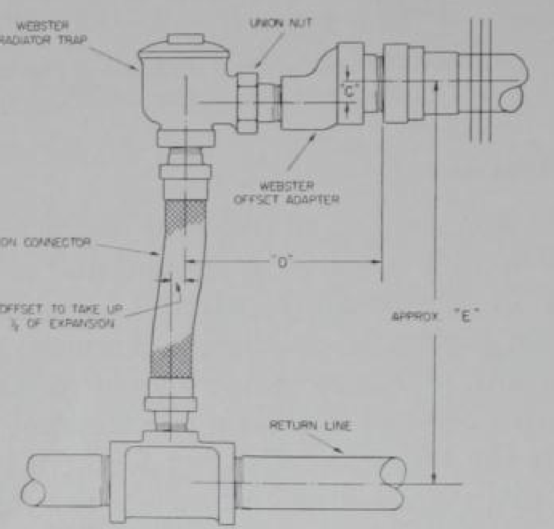


Fig. 15. Webster Offset Adapter (sweat connection) and Trap with Expansion Connector for connection of Heating Element with coupling to return piping.

Table V. Dimensions of Webster Offset Adapter and Trap With Expansion Connector

WI Radiation Size	Trap Size	Offset Adapter Symbol		C	D		E
		Sweat Connection	Screwed Connection		Sweat Connection	Screw Connection	
3″	½″	6402-S	6402	½″	4″	5″	11″-13″
4″	½″	6436-S	6436	¾″	4″	5″	11″-13″
4″	¾″	6436-S	6436	¾″	5″	6″	14″-16″

Suggested Specifications

The following paragraphs may be used as a basic specification for Webster Walvector, modified where necessary to meet special requirements.

WALVECTOR ENCLOSURES—Furnish and install where shown on plans, Webster Walvectors, as manufactured by Warren Webster & Company, Camden 5, N. J. Each Walvector shall be complete with heating element, hangers and enclosure arranged for installation as a unit, or wall to wall as shown on plans.

Cabinet type enclosure top and front shall be of one-piece No. 18-gauge steel construction with streamline grille stamped in sloping portion. Enclosure top and front sheet shall be mounted on a full length angle support. Angle support shall have sponge rubber gasket to prevent air leakage and shall be firmly attached to wall by lag screws or other appropriate means. Adjustable heavy wire hangers shall suspend and position heating element from angle support.

Where Walvector enclosures are used as unit, the ends shall be enclosed to present a workmanlike appearance. For wall-to-wall installation, Walvector enclosure shall finish against side wall. Where two or more lengths of enclosure are used side by side, a trim piece shall cover the joint between sections. Where two lengths of enclosure join at a corner, a trim piece shall be used covering the corner area. 18-gauge steel braces shall be furnished for strengthening enclosure and properly spacing lower edge from wall. All sheet metal parts shall have a gray prime finish.

HEATING ELEMENT—Heating elements shall be non-ferrous, consisting of copper tube with .020″-thick aluminum plate type fins. Tube shall be expanded into collars formed in fins for permanent thermal bond. Heating elements shall be furnished with plain ends for standard sweat fitting connections (or brass adapters having female pipe thread). Complete assembly shall be coated with black paint.

PLAIN COVER—Plain type enclosure shall be of one-piece No. 18-gauge pressed steel with solid front and perforated top. Cover shall extend over all fins of heating element, enclosing front and top and providing 1″ over-hang in the back. Special one-piece wall bracket, made of cold rolled steel, shall suspend and position heating element.

RATINGS—Walvector ratings shall be approved under the I-B-R code for fin tube type radiation.

Fig. 16. Webster Walvector in Cascades School, Jackson, Michigan. Architects & Engineers: Perkins & Will; Heating Contractors: Dart & Cady, Mason, Michigan.

WALVECTOR TRIM PIECES

A number of trim pieces are provided for use with Webster Walvector. These include left and right hand end plates, inside corners, outside corners, narrow butt trim, wide butt trim in $2\frac{1}{2}$, 4 and 6 inch sizes, butt trim with access door and a 12 inch joint section with grille. These are illustrated on this page and dimension information is contained in Table 6.

Fig. 17. Walvector Left Hand End Plate. Width at bottom $3\frac{1}{2}''$ for symbol 3S Enclosure; $4\frac{1}{2}''$ for symbol 4S Enclosure.

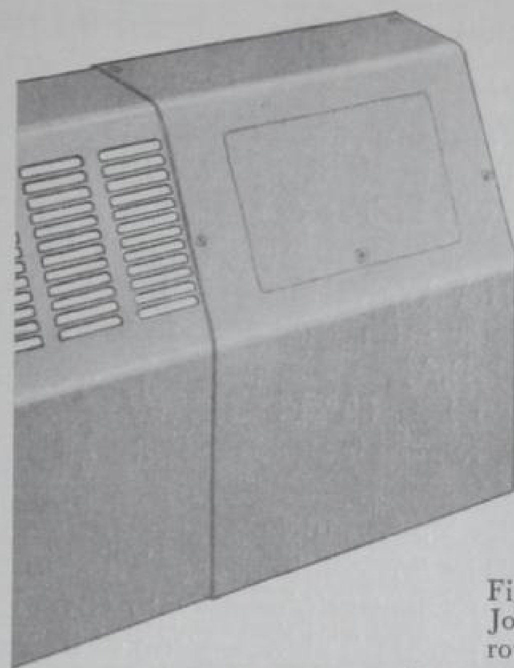


Fig. 18. 9″ Walvector Access Door. Available for all enclosure sizes.

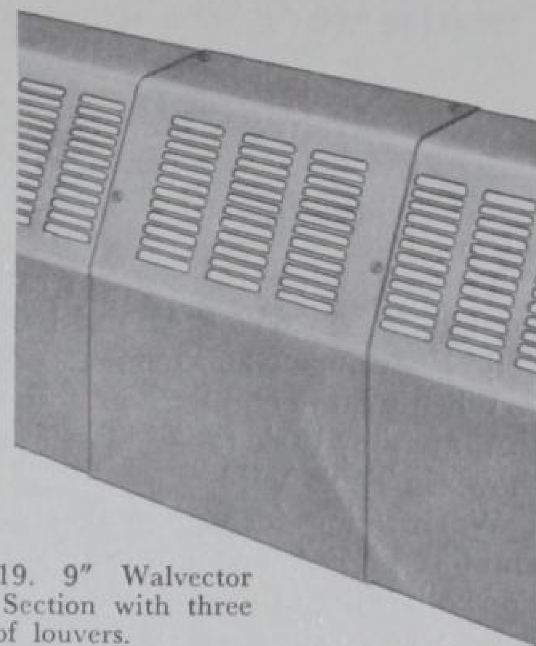


Fig. 19. 9″ Walvector Joint Section with three rows of louvers.

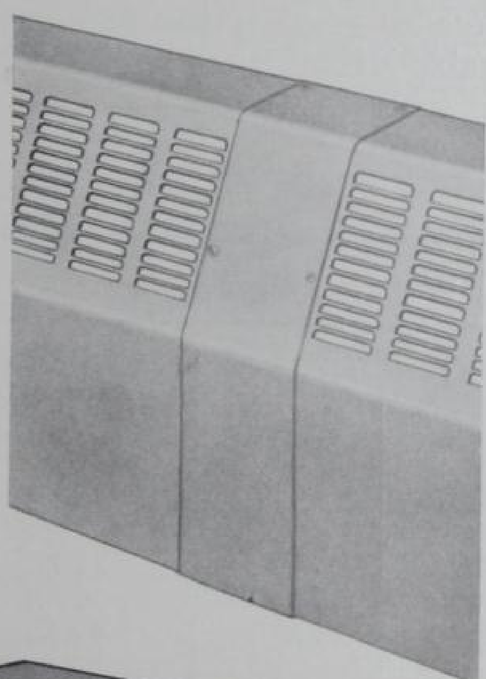


Fig. 20. Walvector Butt Trim. Furnished in $2\frac{1}{2}''$, 4″ and 6″ widths. Available for all enclosure sizes.

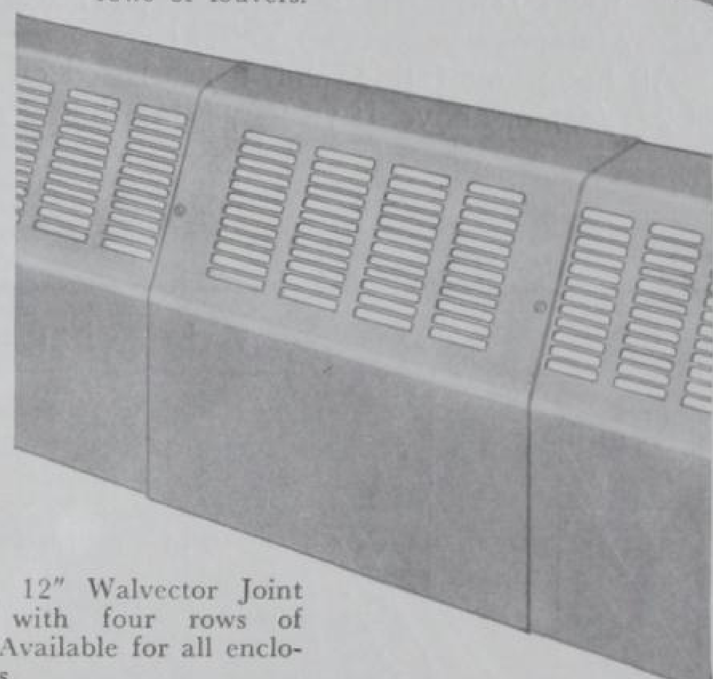


Fig. 21. 12″ Walvector Joint Section with four rows of louvers. Available for all enclosure sizes.

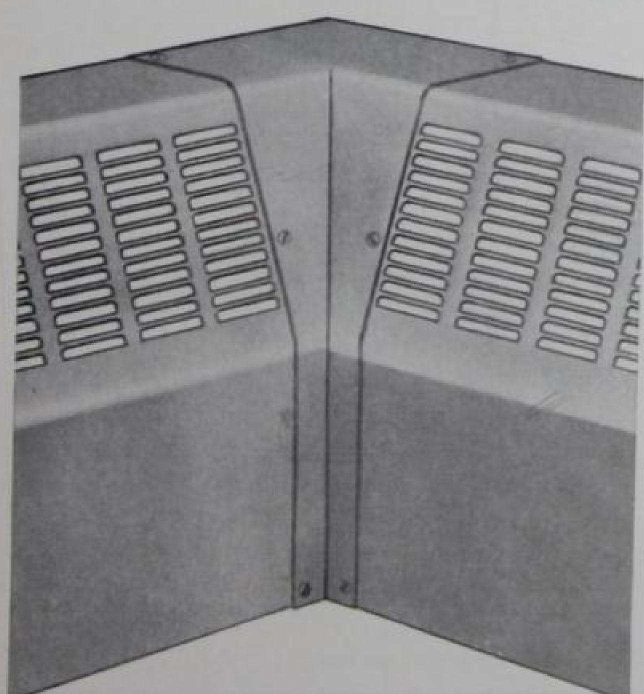


Fig. 22. Walvector Inside Corner Trim. Available for all enclosure sizes.

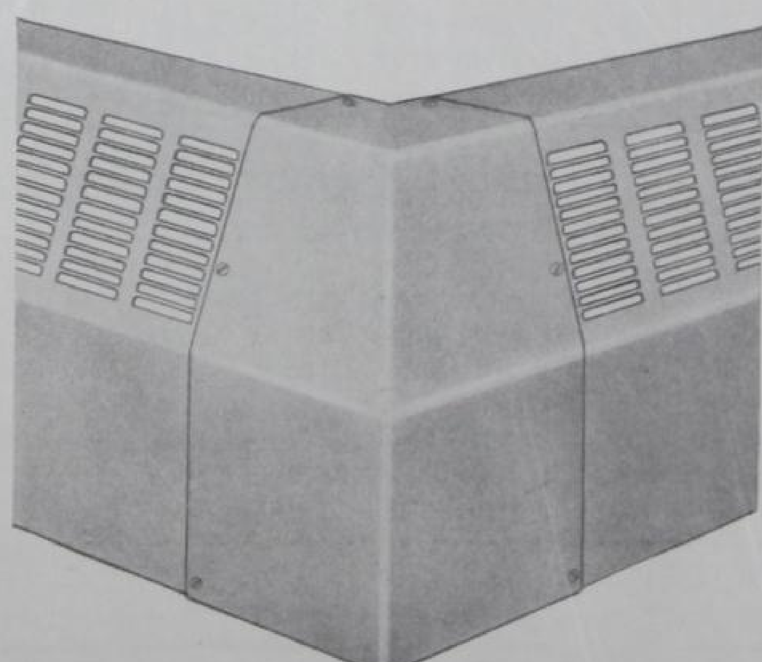


Fig. 23. Walvector Outside Enclosure. Available for all enclosure sizes.

I-B-R RATINGS

WEBSTER WALVECTOR Has Been Tested and Approved Under the I-B-R Code for Fin Tube Type of Radiation

Webster Walvector has been tested and approved under the I-B-R Code for Fin Tube Type of Radiation. Complete rating information is given in Tables VI to XI.

Table VI gives basic steam ratings for Walvector for 1 lb. steam 65° E.A. and basic water ratings @ 200° F. average water temperature, 65° E.A.

When steam conditions are other than 1 lb. 65° F. E.A. multiply basic rating by selected correction factor shown in Table VIII.

Water ratings for various average water temperature and 65° F. E.A. are shown in Table VII. For conditions other than those shown, use Table IX—multiply basic water rating (200° F., 65° E.A.) from Table VI by factor selected from Table IX.

All hot water ratings shown are based on velocity of 2.0′/sec. or above. If velocity is less than 2′/sec. apply factor shown in Table X to water rating selected.

Basic ratings include heating effect in percentage shown when installed at minimum heights as illustrated in catalog details and shown in Table VI. "Installed height" for a Walvector with cover or enclosure is the vertical distance from floor to—

1. The center of the free opening of the inclined outlet in Walvector enclosure as installed.
2. The under side of the horizontal opening of a top outlet cover as installed.

The "installed height" of a Walvector element bare (no cover) is the vertical distance from floor to the top of the uppermost element.

Factors for correcting ratings of Walvector when installed at other than minimum height are shown in Table XI.

TABLE VI. Basic Ratings of Webster Walvector

Fin Size	Cover Symbols	Enclosure Arrangement	STEAM Based on 1 lb. Steam, 65° Ent. Air		HOT WATER Based on 200° Average Water Temp., 65° Ent. Air (0.86 Factor)	HEATING EFFECT	
			Sq. Ft. E.D.R. per Lineal Foot	B.t.u. per Lineal Foot		Installed Height	Factor %
3″	3S	One Row —11″ Walvector Enc.	5.85	1410	1210	12⅝″	12
		One Row —No Cover	4.95	1190	1020	7″	15
		*Two Rows —No Cover	8.60	2060	1770	13″	15
		*Three Rows—No Cover	11.90	2850	2450	19″	14
	3G	One Row —Plain Cover	4.70	1140	980	7″	15
	3G	*Two Rows —Plain Cover	8.20	1970	1690	13″	15
	3G	*Three Rows—Plain Cover	11.40	2720	2340	19″	14
4″	4S	One Row —12½″ Walvector Enc.	8.25	1980	1700	13⅝″	12
	4T	One Row —20″ Walvector Enc.	10.15	2440	2100	20⅞″	9.6
	4D	Two Rows —20″ Walvector Enc.	11.80	2830	2430	20⅞″	9.6
		One Row —No Cover	7.25	1740	1500	8″	15
		†Two Rows —No Cover	12.80	3070	2640	16½″	15
		†Three Rows—No Cover	16.80	4030	3470	25″	8
	4G	One Row —Plain Cover	6.90	1660	1430	8″	15
	4G	†Two Rows —Plain Cover	12.20	2930	2520	16½″	15
	4G	†Three Rows—Plain Cover	16.05	3850	3310	25″	8

* 6″ Centers.
† 8½″ Centers.
Note: These ratings are based on active (finned) length. See page 10 for dimensions. All elements have approximately 50 fins per foot.

Table VII. Extended Hot Water Rating Walvector Based on Indicated Average Water Temperature and 65° Entering Air

Fin Size	Cover Symbol	Enclosure Arrangement	Average Water Temperature ° F. and Factor (See Note) 215° F. 1.00	200° F. 0.86	190° F. 0.78	180° F. 0.69	170° F. 0.61	160° F. 0.53	150° F. 0.45	HEATING EFFECT Installed Height	Factor %
3″	3S	One Row —11″ Walvector Enc.	1410	1210	1100	970	860	750	630	12⅝″	12
		One Row —No Cover	1190	1020	930	820	730	630	540	7″	15
		*Two Rows —No Cover	2060	1770	1610	1420	1260	1090	930	13″	15
		*Three Rows—No Cover	2850	2450	2220	1970	1740	1510	1280	19″	14
	3G	One Row —Plain Cover	1140	980	890	790	700	600	510	7″	15
	3G	*Two Rows —Plain Cover	1970	1690	1540	1360	1200	1040	890	13″	15
	3G	*Three Rows—Plain Cover	2720	2340	2120	1880	1660	1440	1220	19″	14
4″	4S	One Row —12½″ Walvector Enc.	1980	1700	1540	1370	1210	1050	890	13⅝″	12
	4T	One Row —20″ Walvector Enc.	2440	2100	1900	1680	1490	1290	1100	20⅞″	9.6
	4D	Two Rows —20″ Walvector Enc.	2830	2430	2210	1950	1730	1500	1270	20⅞″	9.6
		One Row —No Cover	1740	1500	1360	1200	1060	920	780	8″	15
		†Two Rows —No Cover	3070	2640	2390	2120	1870	1630	1380	16½″	15
		†Three Rows—No Cover	4030	3470	3140	2780	2460	2140	1810	25″	8
	4G	One Row —Plain Cover	1660	1430	1290	1150	1010	880	750	8″	15
	4G	†Two Rows —Plain Cover	2930	2520	2290	2020	1790	1550	1320	16½″	15
	4G	†Three Rows—Plain Cover	3850	3310	3000	2660	2350	2040	1730	25″	8

* 6″ Centers.
† 8½″ Centers.
Note: I-B-R Hot Water Ratings have been determined by applying factors shown to I-B-R approved Steam Ratings.

Table VIII. Correction Factors for Steam Pressures and Air Temperatures Other Than Standard

STEAM PRESSURE Gauge	Abs. Psi	STEAM* Temp. ° F.	ENTERING AIR TEMPERATURE, ° F. 45	55	65	70	75	80
0 Psi	14.696	212.0	1.19	1.09	0.97	0.92	0.87	0.82
.899	15.595	215.0	1.22	1.11	1.00	0.95	0.90	0.84
5	19.70	227.1	1.34	1.22	1.11	1.05	1.00	0.95
10	24.70	239.4	1.45	1.33	1.22	1.17	1.11	1.05
15	29.70	249.8	1.55	1.43	1.31	1.26	1.20	1.14
20	34.70	258.8	1.63	1.52	1.40	1.33	1.28	1.23
25	39.70	266.8	1.71	1.59	1.47	1.41	1.36	1.30
30	44.70	274.0	1.78	1.66	1.54	1.48	1.42	1.37
40	54.70	286.7	1.91	1.79	1.66	1.61	1.54	1.49
50	64.70	297.7	2.02	1.90	1.77	1.71	1.65	1.60
60	74.70	307.3	2.10	2.00	1.87	1.81	1.75	1.69
70	84.70	316.0	2.20	2.09	1.95	1.89	1.83	1.77
80	94.70	323.9	2.27	2.17	2.03	1.97	1.91	1.85
90	104.70	331.2	2.36	2.24	2.11	2.05	1.98	1.93
100	114.70	337.9	2.43	2.31	2.18	2.11	2.05	2.00

* From Keenan & Keys—Linear Interpolation.
Note: Gauge pressure should be corrected for altitude.

Turn page for Correction Factors

Correction Factors

Table IX. Correction Factors for Water When Average Water Temperature and Entering Air Are Other than 200° F. and 65° F.

	Entering Air Temperature ° F.					
Avg. Water Temp. ° F.	45	55	65	70	75	80
150	.640	.581	.525	.498	.473	.440
160	.750	.684	.617	.587	.556	.518
170	.865	.787	.710	.676	.640	.596
180	.980	.890	.805	.764	.725	.675
190	1.11	1.01	.910	.864	.820	.762
200	1.22	1.11	1.00	.950	.900	.840
215	1.42	1.29	1.16	1.10	1.05	.978

(Multiply Basic Hot Water Ratings in Table VII by These Factors.)

Table X. Water Velocity Correction Factors

Water Velocity (Ft. Per Sec.)	Factor
0.5	.947
1.0	.975
2.0 or more	1.000

These Factors Apply to Water Ratings.

Example for Table XI

One row 3″ Walvector 11″ Enclosure with "installed height" of 24″ on 1 lb. steam 65° E.A.

Then: I-B-R Basic Rating (5.85 sq. ft./ft.) $\times \frac{1.072}{1.12} = 5.6$ sq. ft. EDR

Table XI. Factors for Correcting for Various Installed Heights

If Walvector units are installed at greater height than recommended, I-B-R Rating must be adjusted as follows:

$$\text{I-B-R Rating} \times \frac{\text{Factor for Actual Installed Height}}{\text{Factor for Minimum Installed Height}}$$

Installed Height	Factor for No Cover and Plain Cover	Factor for Slope Top Covers
36″ or more	1.00	1.00
34″	1.01	1.008
32″	1.02	1.016
30″	1.03	1.024
29″	1.04	1.032
28″	1.05	1.040
27″	1.06	1.048
26″	1.07	1.056
25″	1.08	1.064
24″	1.09	1.072
23″	1.10	1.080
22″	1.11	1.088
21″	1.12	1.096
20″	1.13	1.104
19″	1.14	1.112
18″ or less	1.15	1.120

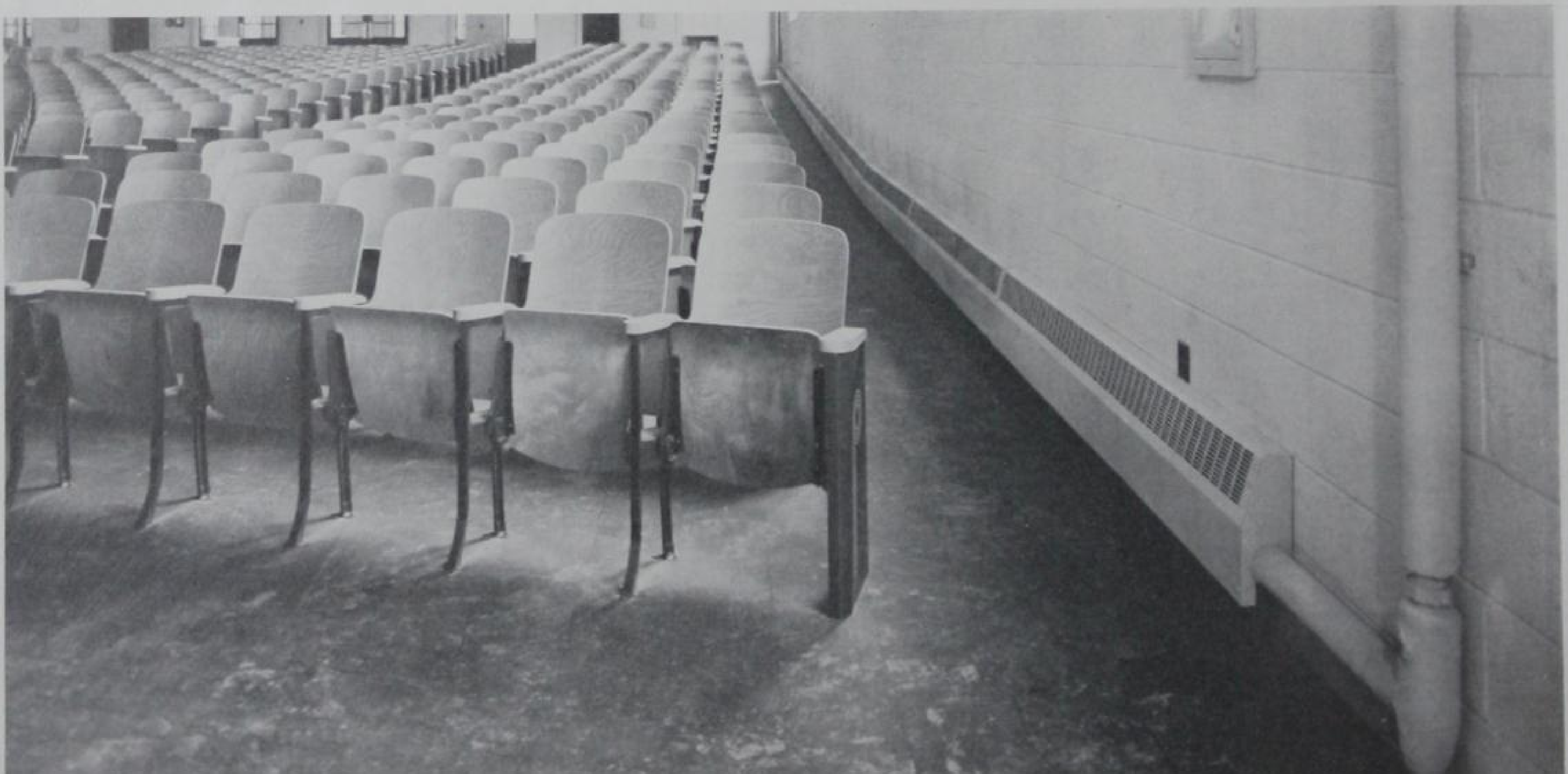


Fig. 24. Webster Walvector in auditorium of Norfolk Catholic High School, Norfolk, Va. Architects: Gleeson & Mulrooney, Philadelphia. Associate Architect: T. David Fitzgibbon, Norfolk. Consulting Engineer: William G. Flurer, Philadelphia. Heating Contractor: Coley and Peterson, Norfolk.

Dimensions of Walvector Heating Element

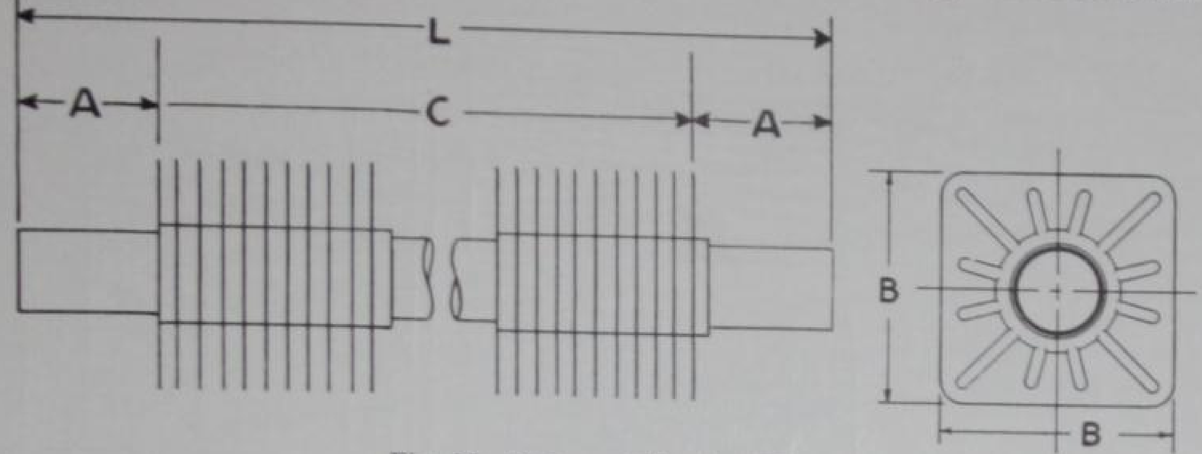


Fig. 25. Plain end Heating Element.

Table XII. Dimensions of 3″ Fin Size Plain End Heating Element

Symbol	Nominal Length C	Actual Length L	A	B	D★
3HP2	2 ft.	2′ 2¼″	1⅛″	3″	1″
3HP3	3 ft.	2′ 2¼″			
3HP4	4 ft.	4′ 2¼″			
3HP5	5 ft.	5′ 2¼″			
3HP6	6 ft.	6′ 2¼″			

Table XIII. Dimensions of 4″ Fin Size Plain End Heating Element

Symbol	Nominal Length C	Actual Length L	A	B	D★
4HP2	2 ft.	2′ 2⅜″	1 3/16″	4″	1¼″
4HP3	3 ft.	3′ 2⅜″			
4HP4	4 ft.	4′ 2⅜″			
4HP5	5 ft.	5′ 2⅜″			
4HP6	6 ft.	6′ 2⅜″			
4HP8	8 ft.	8′ 2⅜″			

★ D—Nominal Copper Tube Size

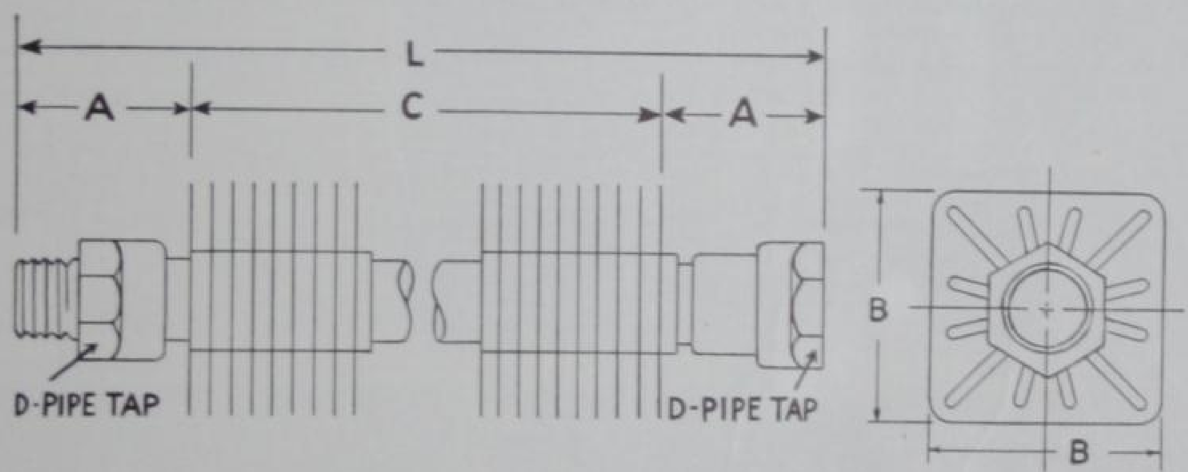


Fig. 26. Heating Element with threaded Brass Adapters.

Table XIV. Dimensions of 3″ Fin Size Heating Element with 1″ Threaded Brass Adapters

Symbol	Nominal Length C	Actual Length L	A	B	I. P. S.
3HA2	2 ft.	2′ 4″	2″	3″	1″
3HA3	3 ft.	3′ 4″			
3HA4	4 ft.	4′ 4″			
3HA5	5 ft.	5′ 4″			
3HA6	6 ft.	6′ 4″			

Table XV. Dimensions of 4″ Fin Size Heating Element with 1¼″ Threaded Brass Adapters

Symbol	Nominal Length C	Actual Length L	A	B	I. P. S.
4HA2	2 ft.	2′ 4⅛″	2 1/16″	4″	1¼″
4HA3	3 ft.	3′ 4⅛″			
4HA4	4 ft.	4′ 4⅛″			
4HA5	5 ft.	5′ 4⅛″			
4HA6	6 ft.	6′ 4⅛″			
4HA8	8 ft.	8′ 4⅛″			

Dimensions of Walvector Enclosures

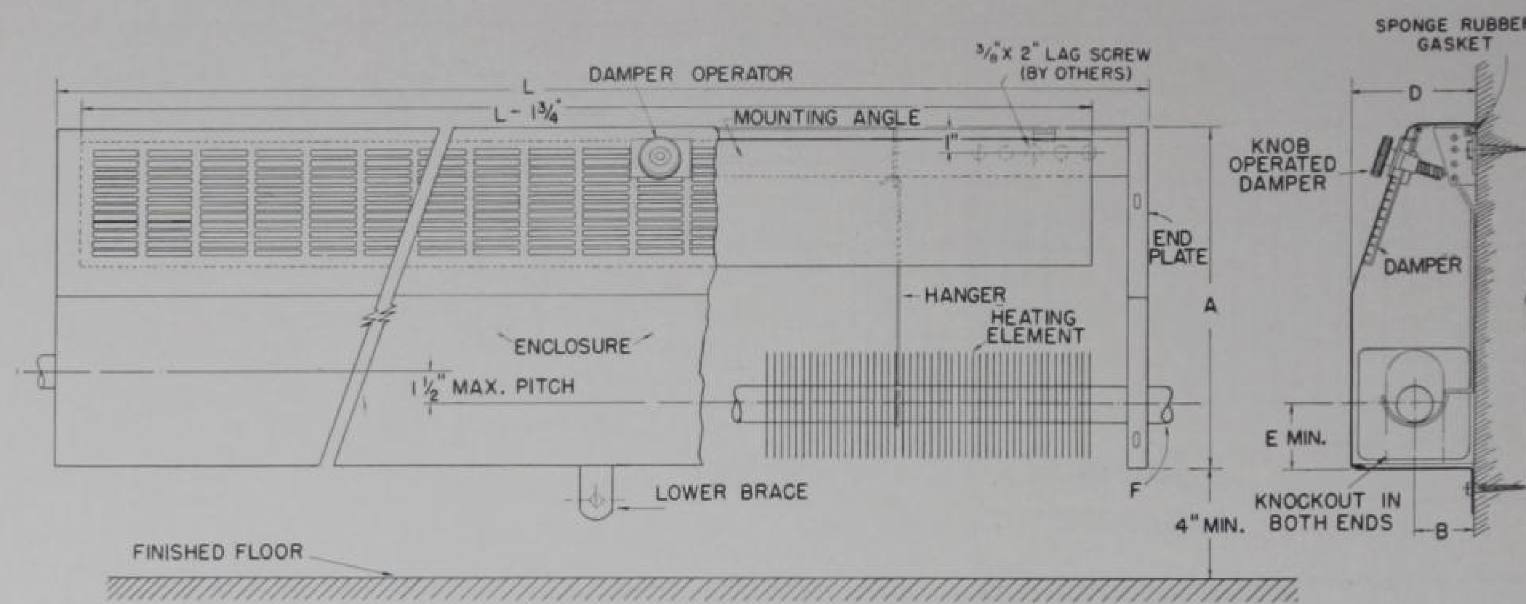


Fig. 27. Webster Walvector using single row of 3" or 4" Heating Element.

Table XVI. Dimensions of Webster Walvector Using Single Row of 3" or 4" Heating Element

Fin Size	Cover Symbol	A	B	C	D	E	F: Sweat Ends Nom. Tube	F: Screwed Ends	Enclosure Length L: Nominal★	Enclosure Length L: Actual
3"	3S	11"	1¾"	11⅛"	3½"	1¾"	1"	1"	2′, 3′, 4′, 5′, 6′, 7′	2′ 4½", 3′ 4½", 4′ 4½", 5′ 4½", 6′ 4½", 7′ 4½"
4"	4S	12½"	2¼"	12⅝"	4½"	2¼"	1¼"	1¼"	2′, 3′, 4′, 5′, 6′, 7′	2′ 4½", 3′ 4½", 4′ 4½", 5′ 4½", 6′ 4½", 7′ 4½"
4"	4T	20"	2¼"	20⅛"	4½"	2¼"	1¼"	1¼"	2′, 3′, 4′, 5′, 6′, 7′	2′ 4½", 3′ 4½", 4′ 4½", 5′ 4½", 6′ 4½", 7′ 4½"

★ Two braces are used where nominal lengths are 2 to 5 ft., inclusive; three braces where nominal lengths are 6 or 7 ft.
Note: For continuous units space braces approximately 3 ft.

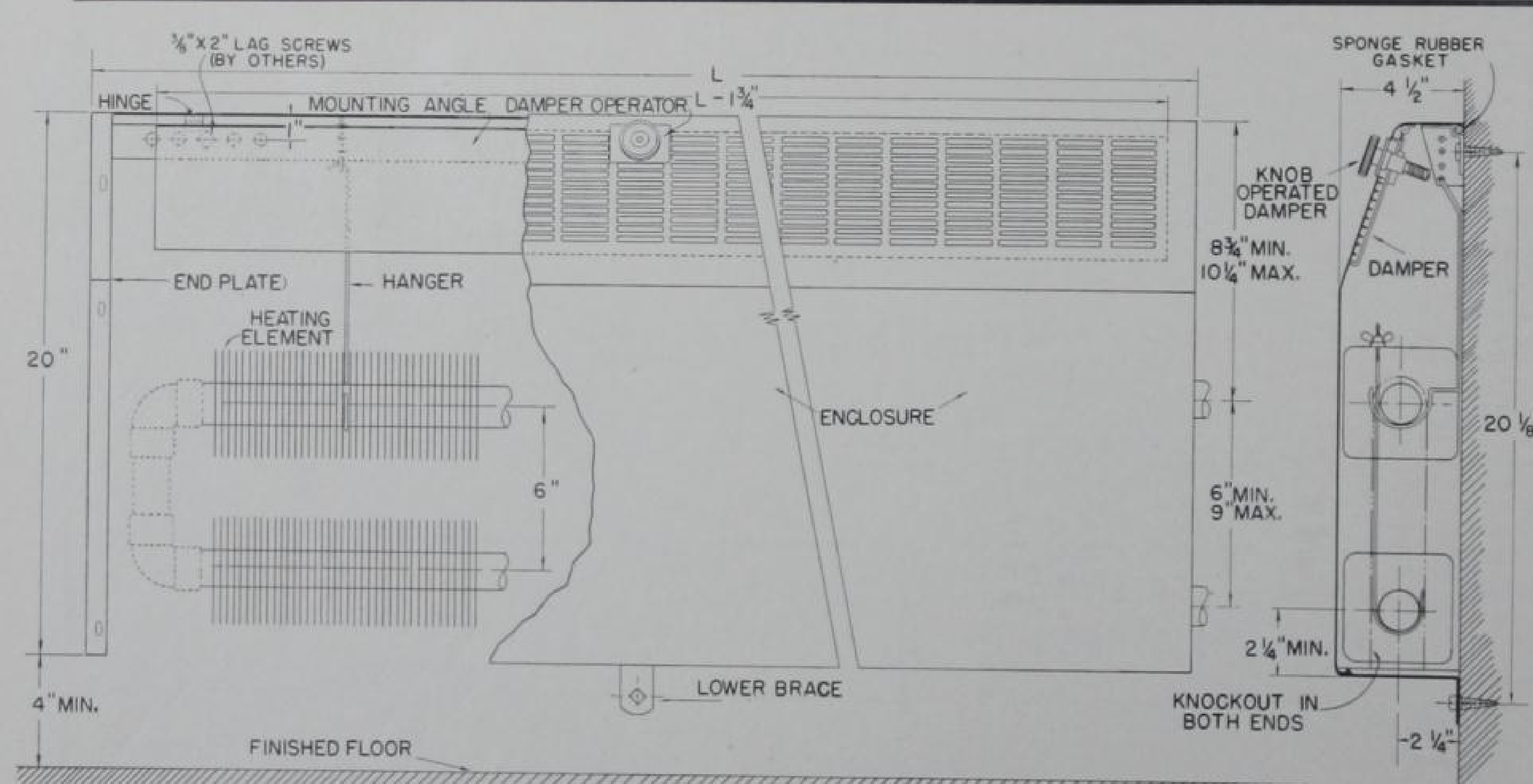


Fig. 28. Webster Walvector using double row of 4" Heating Element.

Table XVII. Dimensions of Webster Walvector Using Double Row of 4" Heating Element

Fin Size	Cover Symbol	Enclosure Length L: Nominal★	Enclosure Length L: Actual
4" Double Row	4D	2′, 3′, 4′, 5′, 6′, 7′	2′ 4½", 3′ 4½", 4′ 4½", 5′ 4½", 6′ 4½", 7′ 4½"

★ Two braces each are used where nominal lengths are 2 to 5 ft., inclusive; three braces where nominal lengths are 6 or 7 ft.
Note: For continuous units space braces approximately 3 ft.

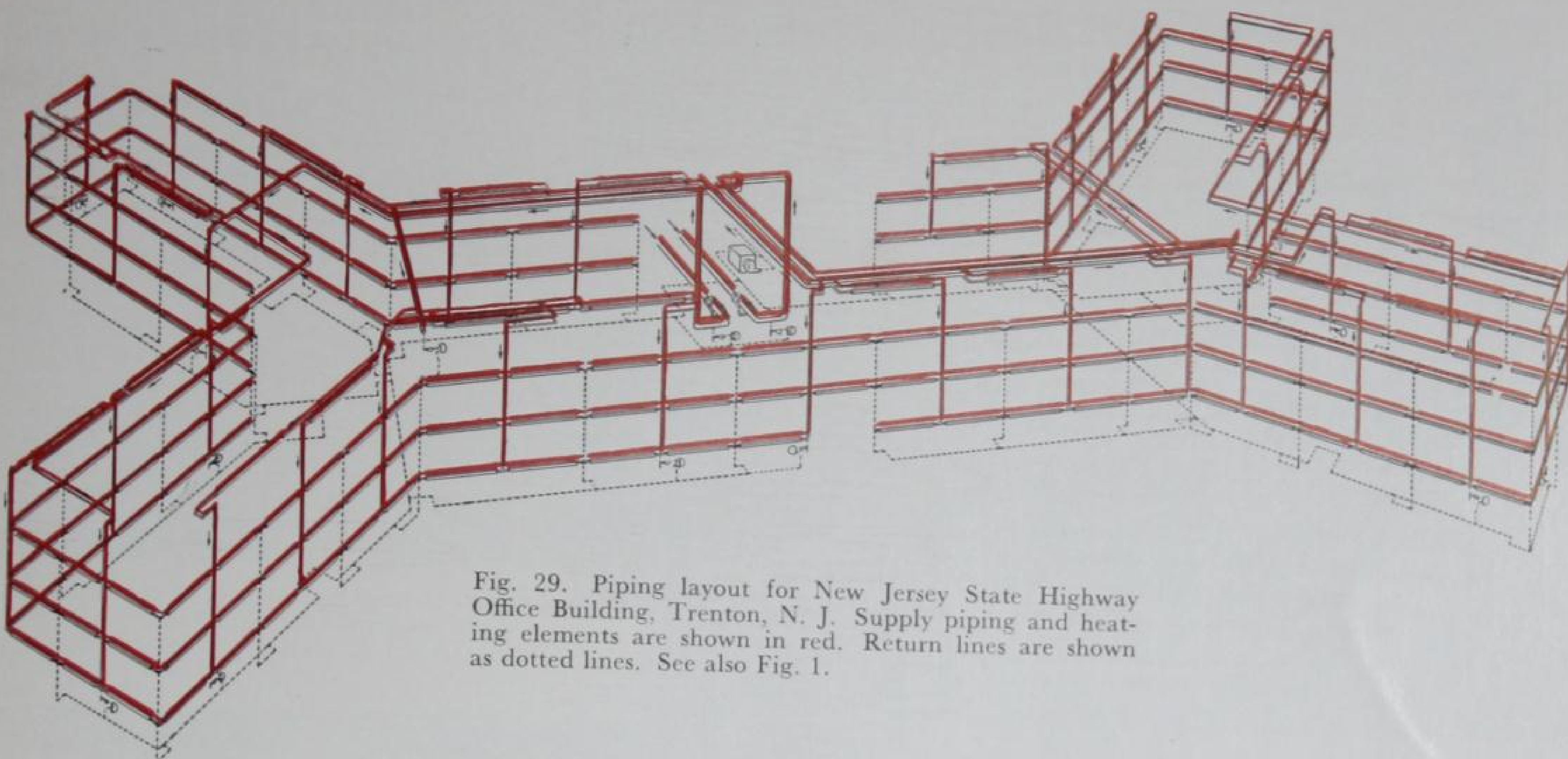


Fig. 29. Piping layout for New Jersey State Highway Office Building, Trenton, N. J. Supply piping and heating elements are shown in red. Return lines are shown as dotted lines. See also Fig. 1.

Fig. 30. Aerial view of New Jersey State Highway Office Building. Micklewright & Mountford, Trenton, Architects. Runyon and Carey, Newark, Consulting Engineers. Philip S. Slack & Co., Trenton, Heating Contractors.

Figs. 31 & 32. Webster Walvector in East Branch, National Bank of Pottstown, Pottstown, Pa. Howell Lewis Shay, Philadelphia, Pa., Architects. E. A. Vanderslice, Engineer. Rodney Morris & Son, Norristown, Pa., Heating Contractors. Fig. 31 on left shows interior of bank. Fig. 32 on right shows Conference Room.

INSTALLATION VIEWS
WEBSTER
WALVECTOR RADIATI

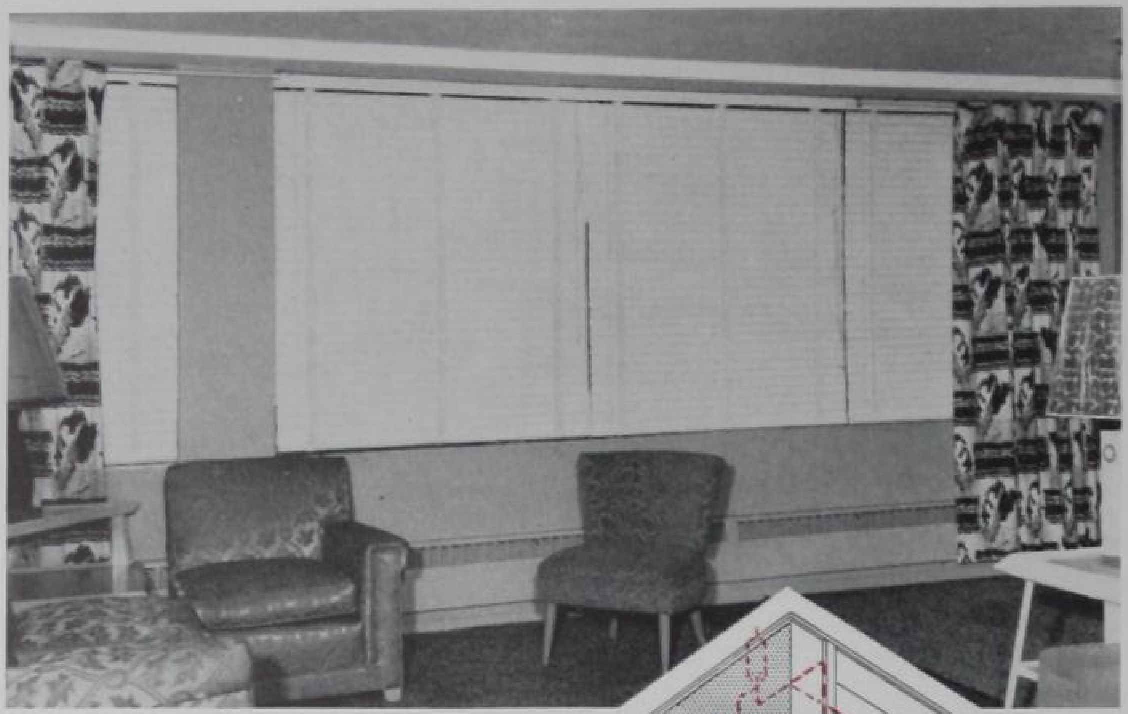


Fig. 33. Interior typical living room, Flamingo Apartments, showing Walvector installation.

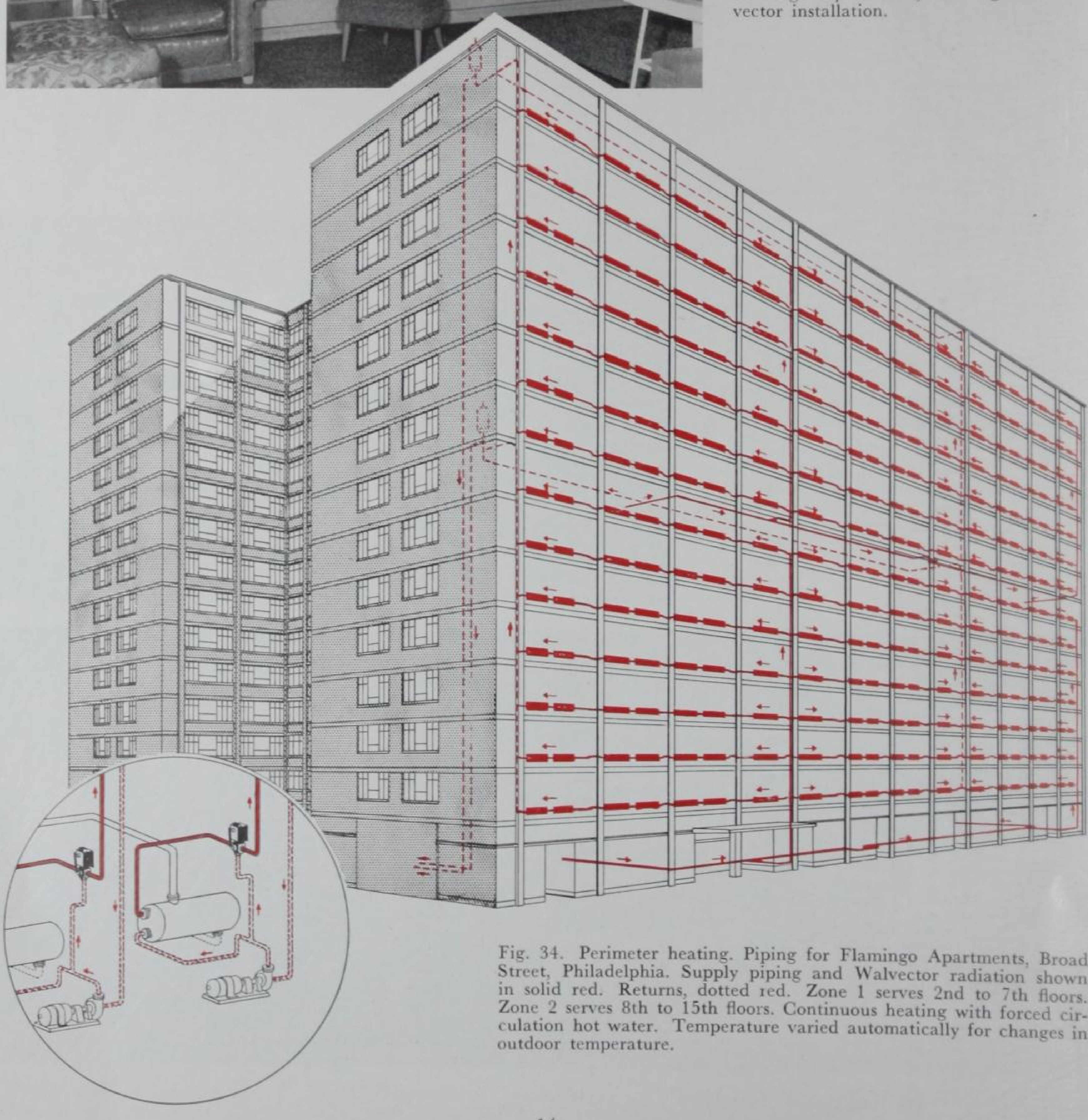


Fig. 34. Perimeter heating. Piping for Flamingo Apartments, Broad Street, Philadelphia. Supply piping and Walvector radiation shown in solid red. Returns, dotted red. Zone 1 serves 2nd to 7th floors. Zone 2 serves 8th to 15th floors. Continuous heating with forced circulation hot water. Temperature varied automatically for changes in outdoor temperature.

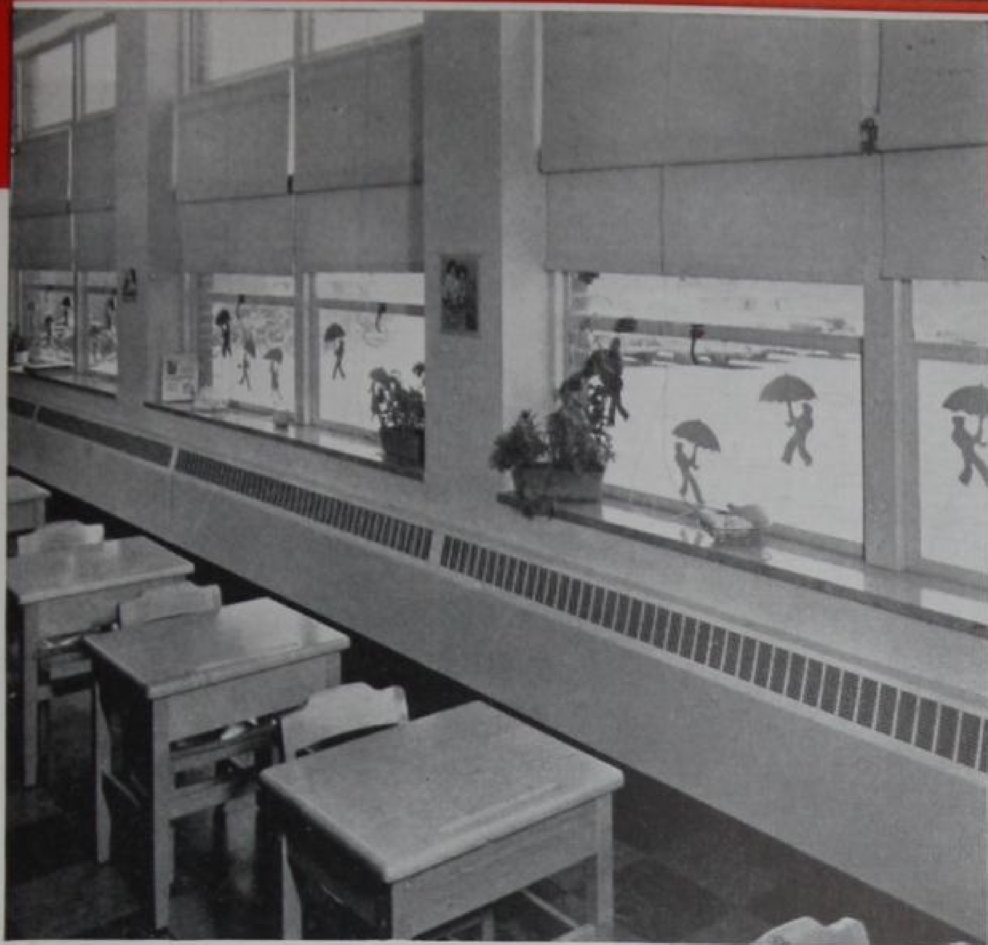


Fig. 35. Wall-to-wall Convectors under windows, Lafayette School, Waterloo, N. Y. Architect: Carl Ade; Heating Contractor: A. Burgart, Inc.

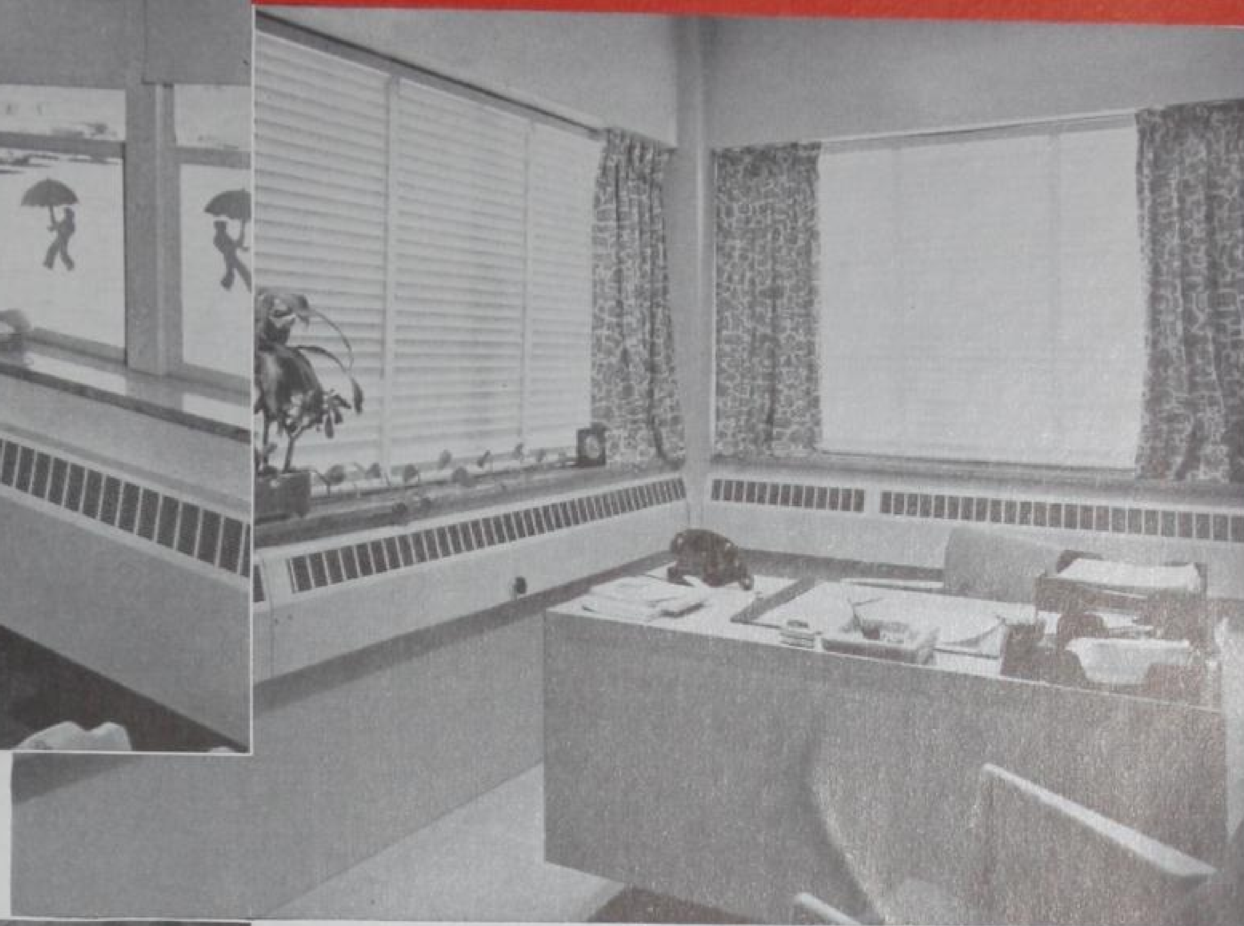


Fig. 37. Walvector in fully air-conditioned Physicians and Surgeons Building, Columbus, Ohio. Architects, Tibbals, Crumley & Musson. Engineer, R. S. Curl and Associates. Contractor, Huffman Wolfe Company.

Fig. 36. Installations around skylight—better, less costly than pipe coils.

Fig. 38. Walvector modernization, office of Merchants Warehouse Company, Philadelphia. F. Wackenhut & Company, Heating Contractors.

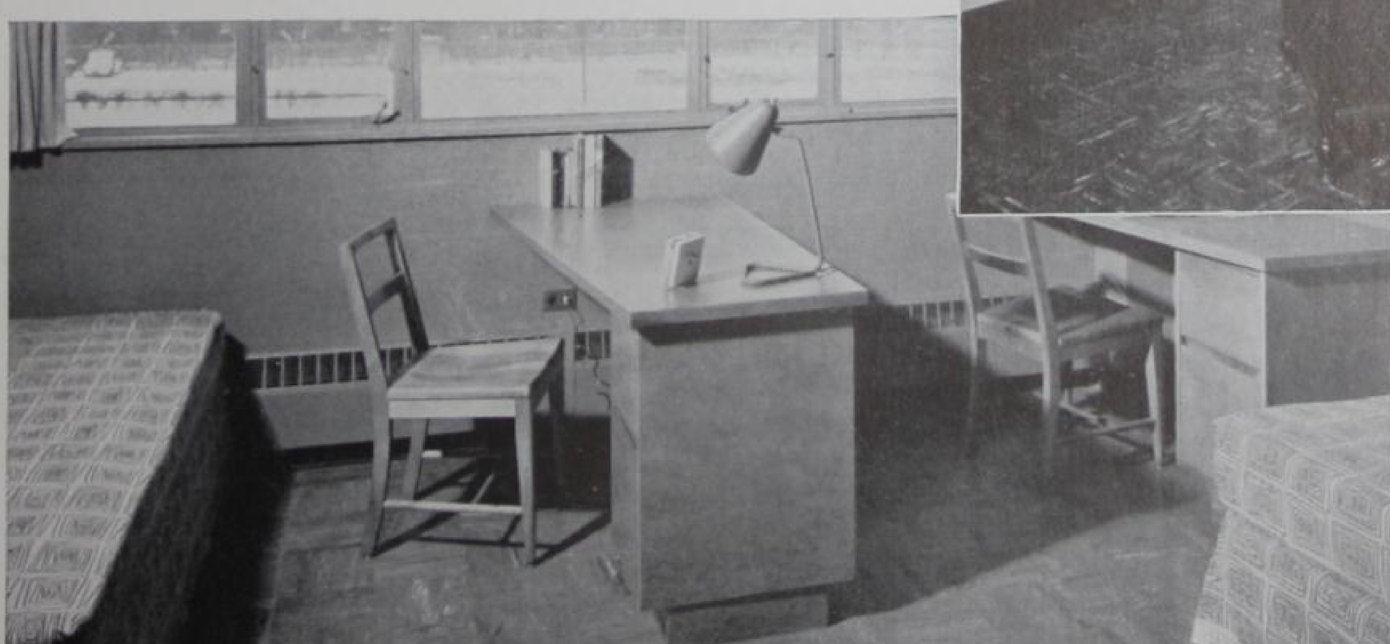


Fig. 39. Walvector in typical student's room, McCormick Theological Seminary dormitory. Edwin H. Mittelbusher and Edward M. Tourtelot, Jr., Architects. Frank W. Riederer, Consulting Engineer. Advance Heating & Air-Conditioning Company, Heating Contractors.

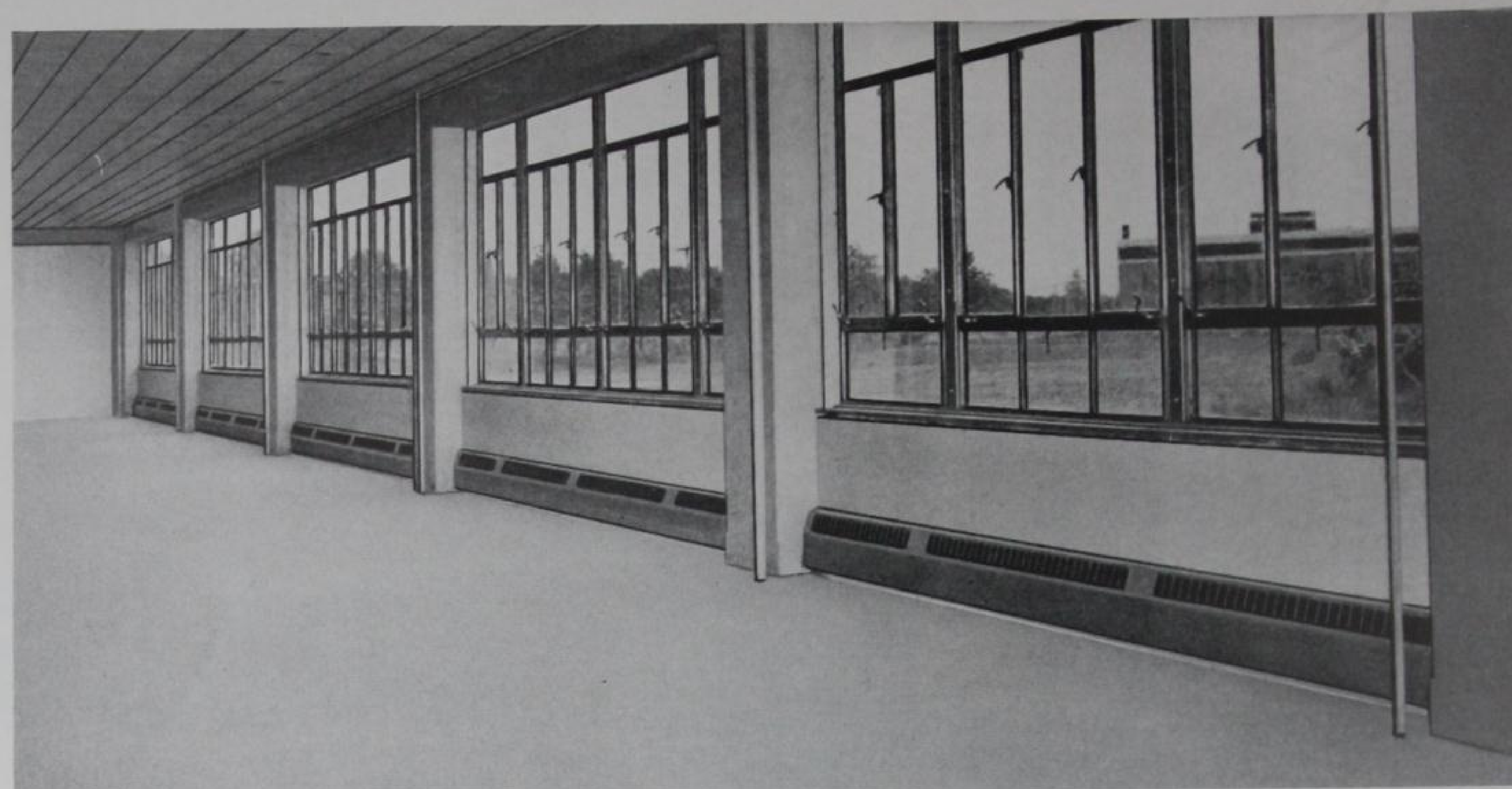


Fig. 40. Webster Walvector in office building. Enclosures and heating elements run column to column with downfeed supply and return risers located at columns. Heating elements are provided with Webster Extended Tube Orifices distributing steam the entire length of enclosure.

How to Obtain Webster Walvector

Inquiries for further information, prices and deliveries on Webster Walvector should be addressed to the nearest Webster representative or to the Company at Camden, New Jersey. Webster Walvector is specified by architects and engineers and sold and installed by reliable heating contractors. Your architect, engineer or contractor will be glad to obtain further information for you from the Webster representative.

Guarantee

Webster Walvector Radiation is guaranteed to deliver full rated capacity when installed as required by our standards and when operated under the conditions upon which the rated capacity is based.

We further warrant equipment of our manufacture to be free from defects in workmanship and material for a period of one year from date of shipment from our factory. This guarantee is limited to repairing or replacing at our option any parts which prove defective within one year, f.o.b. Camden, New Jersey. This guarantee does not include liability for installation cost or contingencies of any character.

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In addition to Webster Walvector, Warren Webster & Company manufacture a complete line of steam and hot water heating system equipment, including radiator valves, thermostatic traps for radiators and process application, float and thermostatic traps, dirt strainers, boiler protectors, boiler return traps, vent traps, Moderator Controls for steam heating, hot water heating controls, Webster System Radiators and Webster Baseboard Heating.

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REG. U. S. PAT. OFF.

RADIATION

APPROVED I=B=R RATINGS

Ur 6-3451

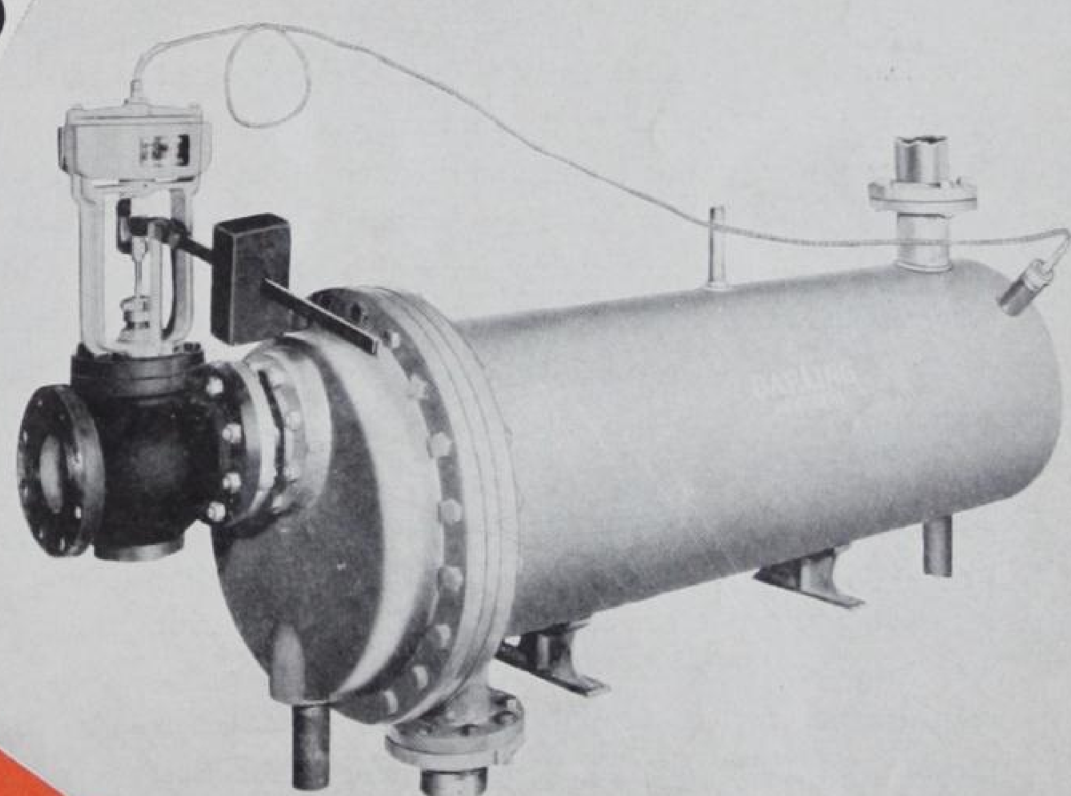
Mr. Missler

BULLETIN No. 25

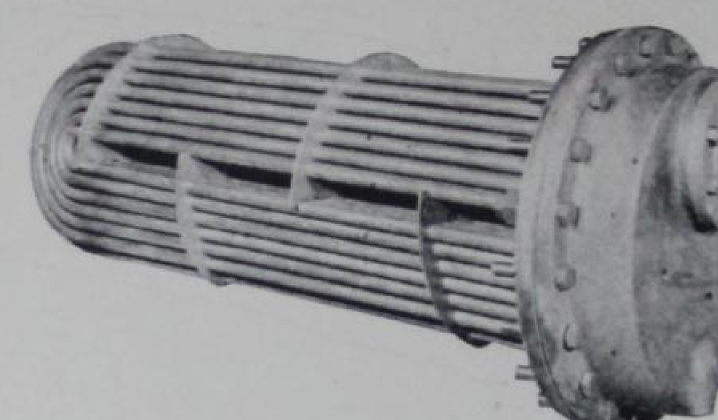
whitlock-darling

TYPE "R"

SEMI-INSTANTANEOUS HEATERS



DESCRIPTION AND APPLICATION



{Air Relief &
{Vac. Breaker Conn.

Heating section of Semi-Instantaneous Heater showing baffles for directional flow.

The Darling Semi-Instantaneous Heater was designed for certain conditions where the conventional instantaneous heater design was found unsatisfactory. One such condition would be for a radiant heating system with relatively low water temperatures and high steam pressure, which would require, ordinarily, an instantaneous heater abnormally large in diameter with a very short shell.

To overcome this necessity, the Darling Semi-Instantaneous Heater was designed and is highly recommended for this and many other applications. This design, with water in the shell and steam in the tubes, meets the requirements for conventional dimensions and also provides facilities for good temperature regulation, besides being very flexible over a large range of capacities.

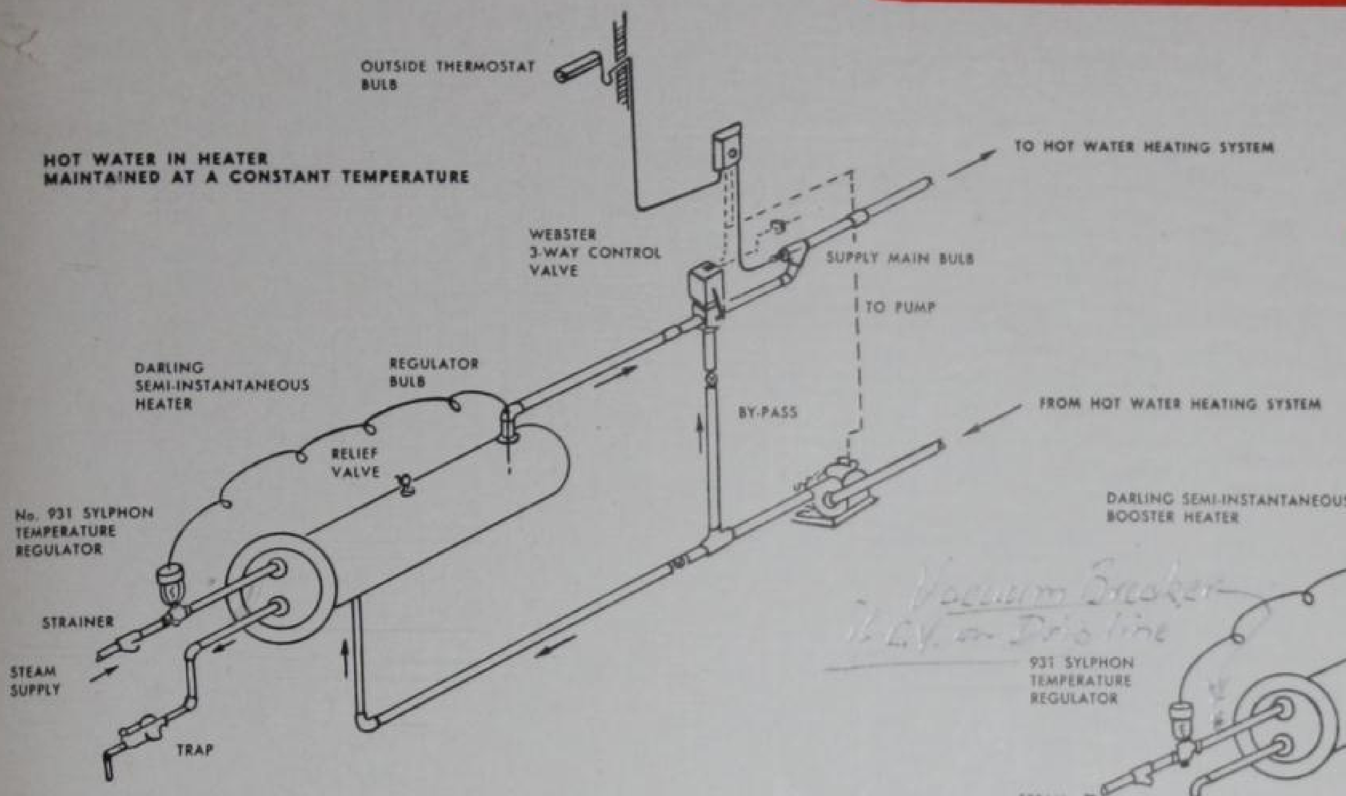
The Darling Semi-Instantaneous Heater is ideally suited to the many large industries which are installing a number of washrooms throughout their plants where reduced costs and limited space are important factors. Usually in plants of this size an adequate amount of steam is available and the consumption of steam for the production of hot water is a minor item in the steam load. We do not recommend, however, the use of the Semi-Instantaneous Heater in apartment houses, etc., where the demand could cause objectionable peaks and draw heat away from the heating system.

There is a considerable field available for the Semi-Instantaneous Heater in Hotels, Restaurants, Cafeterias and Laundries, as booster heaters to raise the temperatures of the ordinary hot water service up to the high temperatures required for dish washing machines and laundry washers.

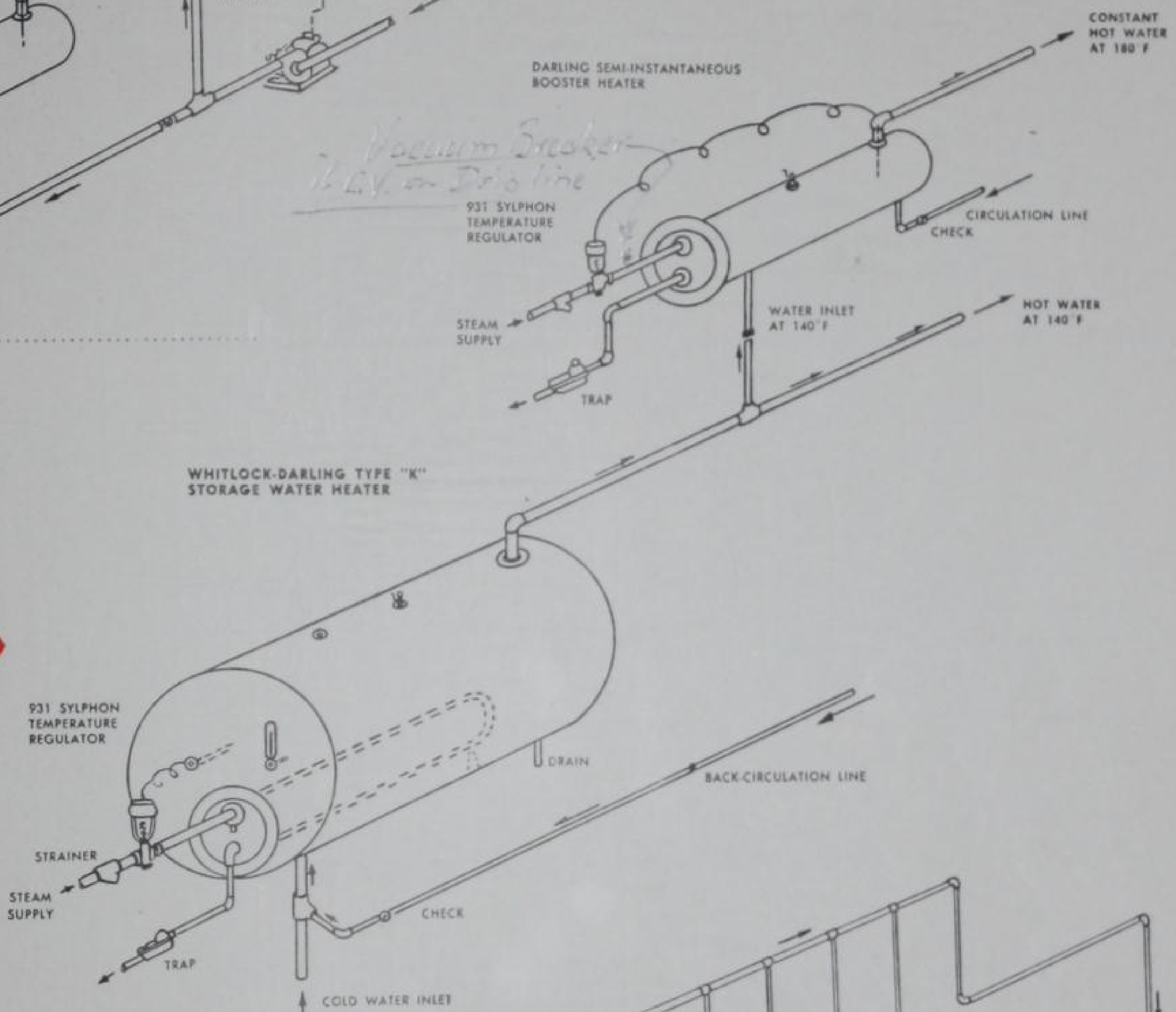
Many other conditions are suitable for Semi-Instantaneous Heaters, among which are warm water service for removing snow and ice from cars and trucks in winter, and many other applications.

TYPICAL LAYOUTS

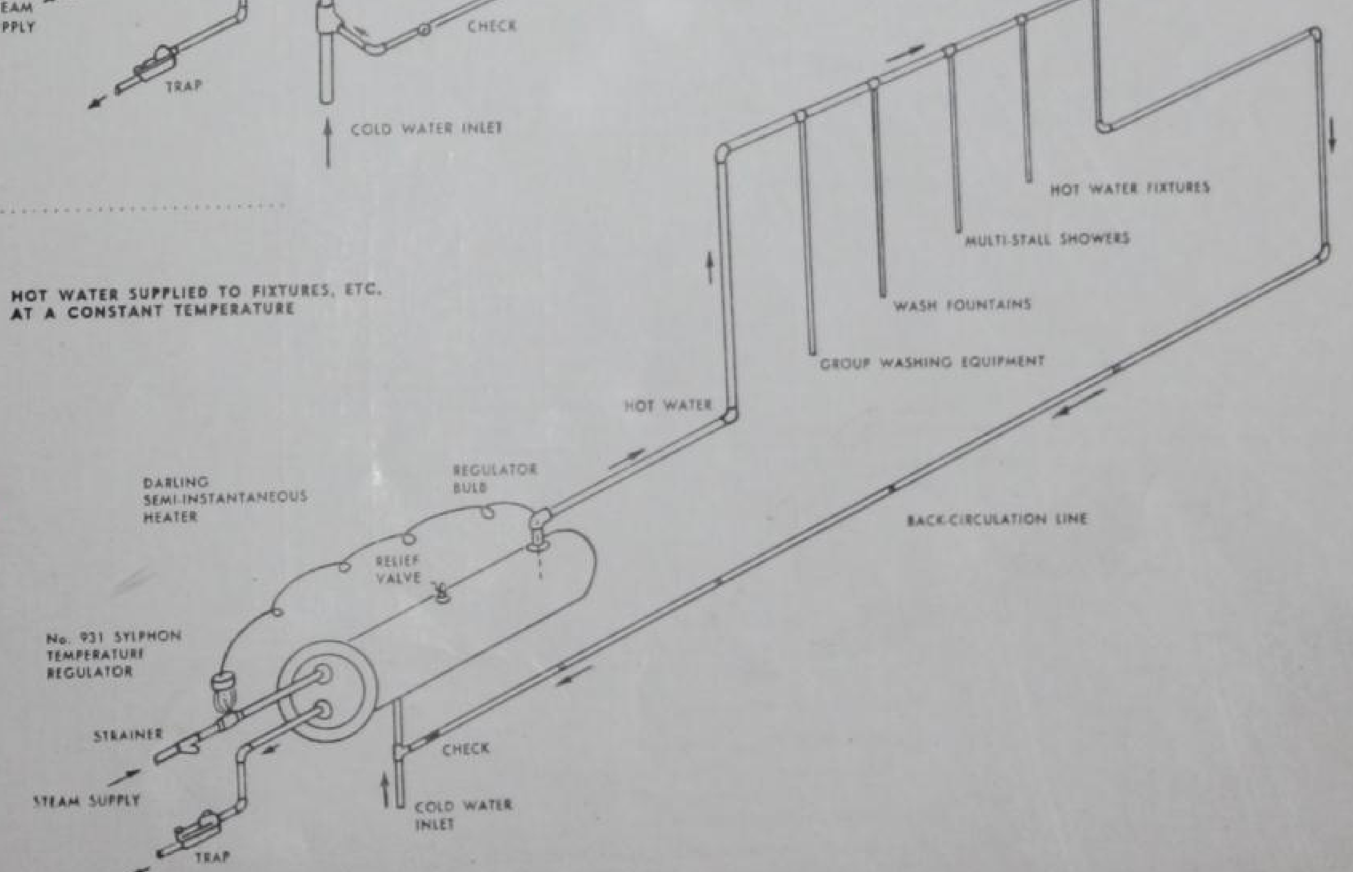
Typical layout for hot water heating system.



Typical layout for combined domestic water supply and booster service for dishwashing, laundry, etc.



Typical layout for domestic hot water supply (Industrial Application).



CAPACITIES IN U.S. GALLONS PER HOUR

Temperature Ranges:—120°-140°F., 160°-180°F., 190°-215°F., Hot Water Heating Systems — 140°-180°F., Booster Heater for Dishwasher, Laundry, etc. — 40°-140°F., 40°-180°F., Domestic Hot Water Supply.

Size of Heater	2-5 PSIG STEAM Temperature Rise of Water				
	120°-140°	160°-180°	140°-180°	40°-140°	40°-180°
3	890	490	280	240	130
4	1120	610	360	260	160
5	1340	730	430	370	200
6	1790	980	570	490	260
7	2240	1230	720	610	330
8	2690	1480	860	740	400
9	3580	1970	1150	980	530
10	4490	2460	1440	1230	660
11	5600	3070	1800	1540	830
12	6710	3690	2160	1840	1000
13	8980	4940	2890	2470	1330
14	11200	6160	3610	3040	1660
15	13500	7360	4340	3710	2000
16	17900	9850	5760	4940	2660
17	22100	12100	7120	6080	3280
18	26900	14800	8680	7420	4000
18½	31500	17300	10100	8660	4670
19	35800	19700	11500	9850	5310
19½	40400	22200	13000	11100	5980
20	44900	24600	14400	12300	6600

Size of Heater	10 PSIG STEAM Temperature Rise of Water					
	120°-140°	160°-180°	190°-215°	140°-180°	40°-140°	40°-180°
3	1080	680	290	380	280	160
4	1350	860	350	480	360	200
5	1630	1030	420	580	430	240
6	2170	1370	560	770	570	330
7	2720	1720	710	970	720	410
8	3260	2060	850	1160	860	490
9	4340	2740	1130	1550	1150	660
10	5440	3440	1420	1950	1440	800
11	6780	4290	1770	2420	1800	1030
12	8140	5150	2120	2910	2160	1230
13	10900	6880	2840	3880	2880	1650
14	13600	8600	3550	4860	3610	2060
15	16300	10300	4260	5830	4330	2480
16	21700	13700	5670	7760	5760	3290
17	26800	16900	7000	9670	7110	4060
18	32600	20600	8540	11600	8660	4960
18½	38100	24100	9970	13600	10100	5780
19	43400	27400	11360	15500	11500	6590
19½	48900	30900	12700	17500	13000	7420
20	54400	34400	14100	19400	14400	8250

Size of Heater	15 PSIG STEAM Temperature Rise of Water					
	120°-140°	160°-180°	190°-215°	140°-180°	40°-140°	40°-180°
3	1200	790	360	440	300	180
4	1500	980	460	550	380	220
5	1800	1180	550	660	460	270
6	2410	1580	730	880	610	360
7	3010	1980	920	1110	770	450
8	3620	2370	1100	1330	920	540
9	4820	3160	1470	1770	1230	720
10	6030	3960	1840	2220	1540	890
11	7530	4940	2300	2770	1930	1130
12	9020	5920	2760	3320	2310	1360
13	12000	7910	3680	4440	3470	1810
14	15000	9890	4610	5550	3860	2270
15	18100	11800	5530	6660	4640	2730
16	24100	15800	7350	8850	6170	3620
17	29700	19500	9200	10900	7610	4470
18	36200	23800	11000	13300	9280	5450
18½	42600	27700	12900	15500	10800	6360
19	48200	31600	14700	17700	12300	7250
19½	54200	35600	16500	19900	13900	8160
20	60300	39600	18400	22200	15400	9070

Size of Heater	25 PSIG STEAM Temperature Rise of Water					
	120°-140°	160°-180°	190°-215°	140°-180°	40°-140°	40°-180°
3	1370	960	500	520	340	200
4	1710	1200	630	660	430	260
5	2050	1440	760	790	510	310
6	2730	1920	1010	1050	680	410
7	3430	2400	1270	1320	860	520
8	4120	2890	1530	1590	1030	620
9	5470	3840	2030	2110	1370	830
10	6850	4810	2540	2650	1720	1040
11	8550	6000	3180	3300	2140	1300
12	10200	7200	3810	3960	2570	1560
13	13700	9620	5100	5300	3440	2080
14	17100	12000	6360	6620	4330	2610
15	20600	14400	7650	7950	5160	3130
16	27300	19200	10100	10500	6860	4160
17	33800	23700	12500	13000	8480	5140
18	41200	28900	15300	15900	10300	6260
18½	48100	33700	17800	18500	12000	7320
19	54700	38400	20300	21100	13700	8330
19½	61600	43200	22900	23800	15500	9380
20	68600	48100	25400	26500	17200	10400

Size of Heater	50 PSIG STEAM Temperature Rise of Water					
	120°-140°	160°-180°	190°-215°	140°-180°	40°-140°	40°-180°
3	1660	1270	760	680	400	250
4	2080	1590	950	850	510	320
5	2500	1910	1140	1020	610	380
6	3330	2540	1520	1360	810	510
7	4170	3180	1910	1710	1020	640
8	5010	3820	2290	2050	1230	760
9	6660	5090	3050	2720	1630	1020
10	8340	6370	3820	3410	2020	1280
11	10400	7950	4770	4260	2550	1600
12	12500	9540	5710	5110	3030	1910
13	16700	12700	7650	6830	4080	2550
14	20800	15900	9550	8530	5110	3200
15	25000	19100	11500	10200	6140	3840
16	33300	25400	15200	13600	8160	5100
17	41100	31400	18800	16800	10000	6300
18	50100	38300	22900	20500	12300	7670
18½	58500	44700	26800	23900	14300	8960
19	66600	50900	30500	27200	16300	10200
19½	75000	57300	34400	30700	18400	11500
20	83400	63700	38200	34100	20400	12700

Size of Heater	75 PSIG STEAM Temperature Rise of Water					
	120°-140°	160°-180°	190°-215°	140°-180°	40°-140°	40°-180°
3	1900	1500	930	790	450	280
4	2380	1880	1170	990	560	360
5	2850	2250	1400	1190	670	430
6	3800	3010	1870	1590	900	570
7	4760	3760	2350	1990	1130	720
8	5720	4520	2820	2390	1360	860
9	7610	6010	3750	3180	1810	1150
10	9530	7530	4700	3980	2260	1430
11	11900	9400	5860	4970	2830	1800
12	14200	11200	7030	5960	3390	2160
13	19000	15000	9400	7970	4540	2890
14	23800	18800	11700	9960	5660	3610
15	28600	22600	14100	12000	6800	4340
16	38000	30100	18700	15900	9050	5770
17	47000	37100	23100	19600	11100	7120
18	67200	45200	28200	23900	13600	8680
18½	66900	52800	32900	28000	15900	10100
19	76100	60100	37500	31800	18100	11500
19½	85700	67600	42200	35800	20300	13000
20	95300	75200	47000	39800	22600	14400

Size of Heater	100 PSIG STEAM Temperature Rise of Water					
	120°-140°	160°-180°	190°-215°	140°-180°	40°-140°	40°-180°
3	2040	1660	1080	880	490	310
4	2550	2080	1350	1110	610	390
5	3060	2500	1620	1330	730	470
6	4070	3330	2170	1770	980	620
7	5110	4170	2720	2220	1220	780
8	6130	5010	3260	2670	1470	940
9	8150	6660	4340	3550	1960	1250
10	10210	8340	5440	4450	2450	1570
11	12750	10400	6790	5550	3330	1960
12	15310	12500	8140	6650	3670	2350
13	20400	16700	10800	8900	4910	3150
14	25500	20800	13500	11100	6140	3940
15	30700	25000	16300	13300	7360	4730
16	40700	33300	21700	17700	9800	6290
17	50300	41100	26800	21900	12100	7700
18	61300	50100	32600	26700	14700	9400
18½	71600	58500	38100	31200	17200	11000
19	81500	66600	43400	35500	19600	12600
19½	91900	75000	48900	40000	22000	14100
20	102100	83400	54400	44500	24500	15700

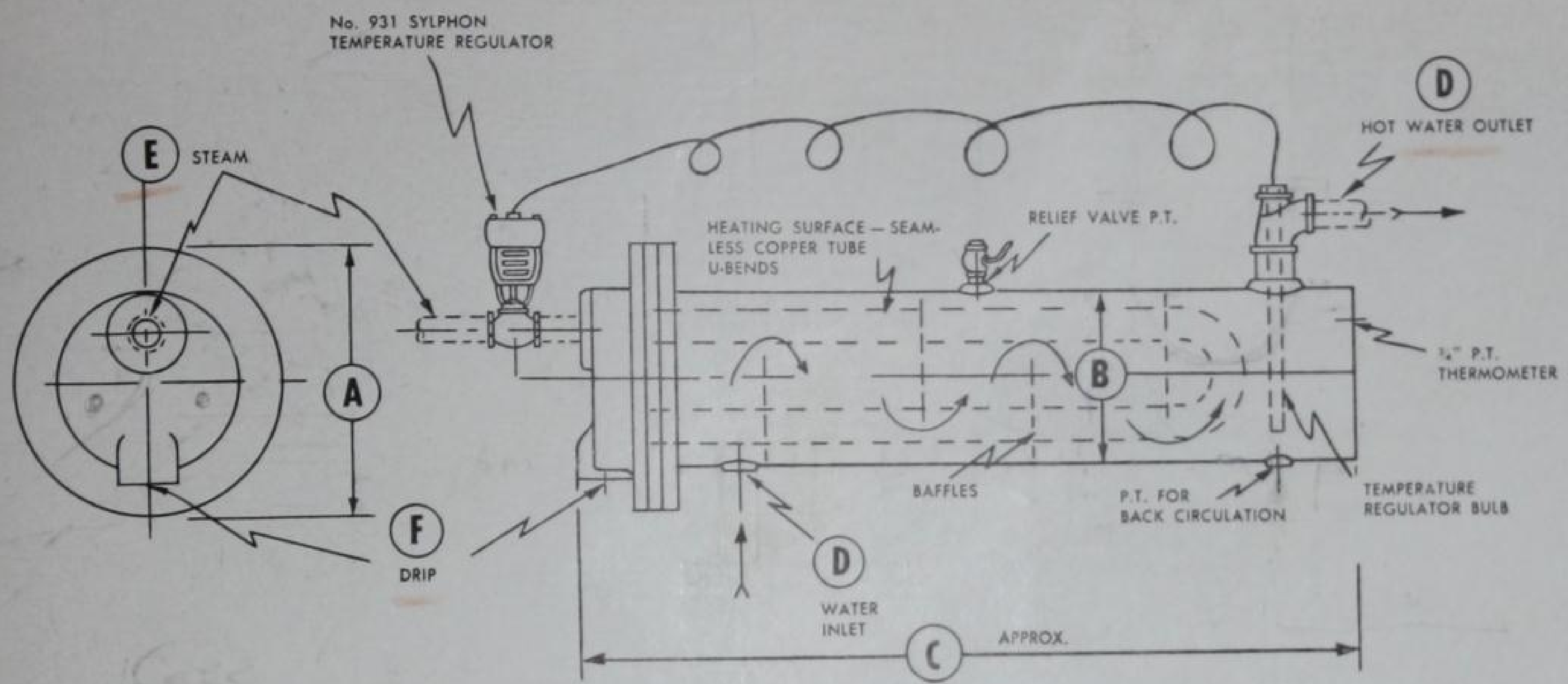
Size of Heater	125 PSIG STEAM Temperature Rise of Water					
	120°-140°	160°-180°	190°-215°	140°-180°	40°-140°	40°-180°
3	2220	1820	1190	950	520	330
4	2770	2270	1490	1190	650	420
5	3330	2720	1790	1430	780	500
6	4440	3630	2390	1910	1040	670
7	5560	4550	3000	2390	1300	840
8	6680	5460	3600	2875	1560	1010
9	8880	7260	4780	3820	2070	1340
10	11100	9100	5990	4790	2600	1680
11	13800	11300	7480	5970	3240	2100
12	16600	13600	8960	7160	3890	2520
13	22200	18200	12000	9570	5200	3360
14	27800	22700	14900	11980	6500	4210
15	33400	27300	18000	14400	7810	5050
16	44400	36300	23900	19100	10300	6710
17	54700	44800	29500	23600	12800	8280
18	66700	54600	36000	28800	15600	10100
18½	78000	63800	42000	33600	18200	11800
19	88800	72600	47800	38200	20700	13400
19½	100000	81800	53900	43100	23400	15100
20	111000	91000	59900	47900	26000	16800

Size of Heater	150 PSIG STEAM Temperature Rise of Water					
	120°-140°	160°-180°	190°-215°	140°-180°	40°-140°	40°-180°
3	2380	1940	1300	1020	540	350
4	2970	2420	1620	1280	680	440
5	3570	2910	1940	1530	820	530
6	4750	3880	2590	2050	1090	710
7	5950	4860	3250	2560	1370	890
8	7150	5840	3900	3080	1640	1070
9	9510	7760	5190	4100	2180	1420
10	11900	9720	6500	5130	2730	1780
11	14800	12100	8110	6400	3410	2220
12	17800	14500	9720	7680	4090	2660
13	23800	19400	13000	10200	5470	3560
14	29800	24300	16200	12800	6840	4450
15	35800	29200	19500	15400	8210	5340
16	47500	38800	25900	20500	10900	7100
17	58600	47800	32000	25300	13500	8770
18	71500	58400	39000	30800	16400	10700
18½	83500	68100	45600	36000	19200	12500
19	95100	77600	51900	41000	21800	14200
19½	107100	87400	58400	46100	24600	16000
20	119100	97100	65000	51300	27300	17800

DARLING BROTHERS LIMITED

SIZES AND ROUGHING-IN DIMENSIONS

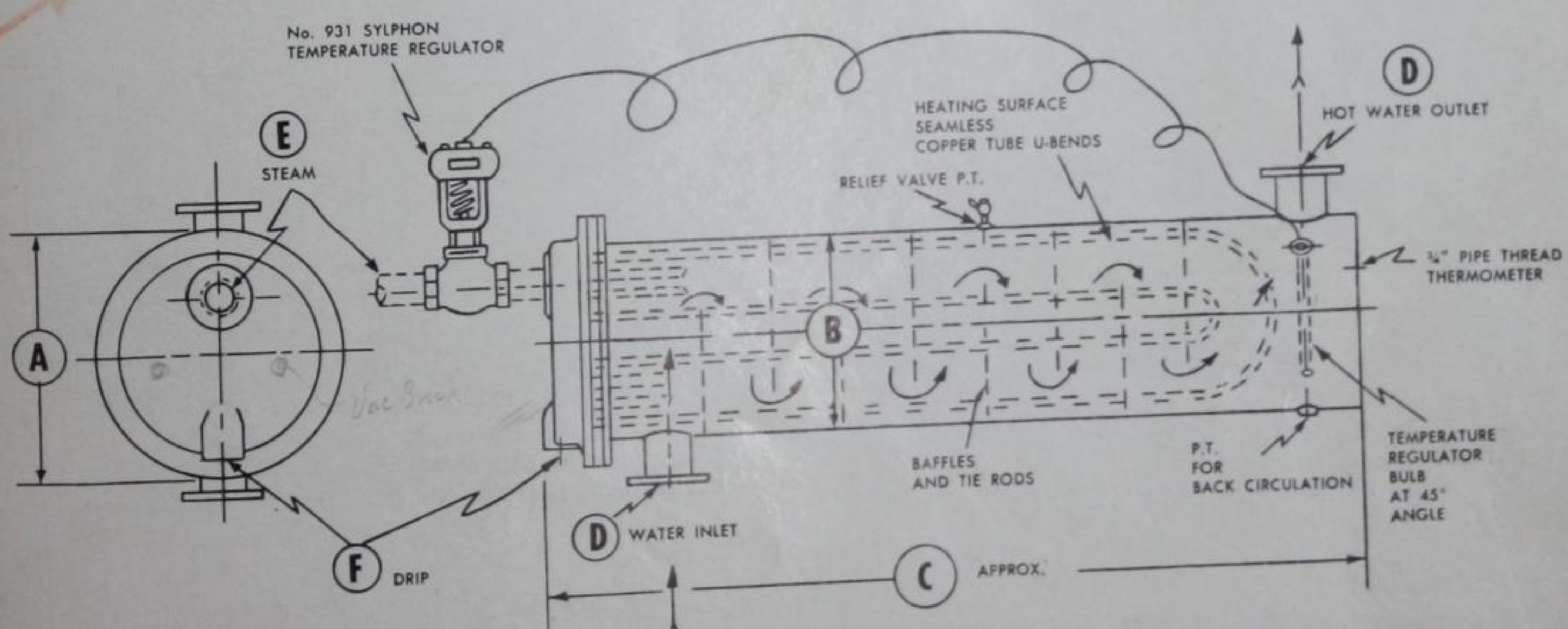
HEATER SIZES 3-13



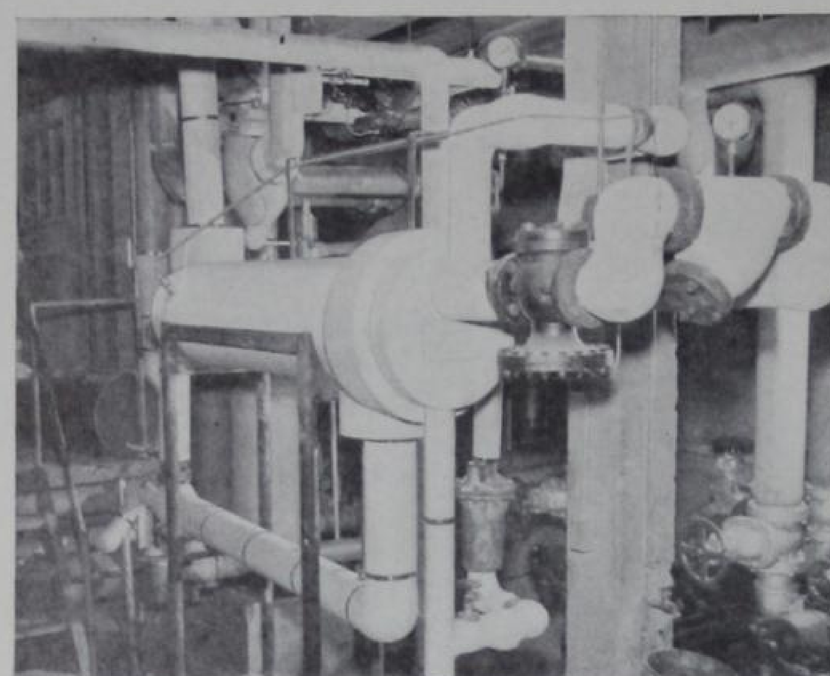
	HEATER SIZE																		
	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11	No. 12	No. 13	No. 14	No. 15	No. 16	No. 17	No. 18	No. 18½	No. 19	No. 19½	No. 20
A	10¼"	10¼"	10¼"	10¼"	10¼"	10¼"	13¼"	13¼"	13¼"	16¼"	16¼"	19¼"	19¼"	19¼"	22¼"	22¼"	25¼"	25¼"	25¼"	25¼"
B	6"	6"	6"	6"	6"	6"	8"	8"	8"	10"	10"	14"	14"	14"	16"	16"	20"	20"	20"	20"
C	2'-3"	2'-8"	3'-0"	3'-10"	4'-7"	5'-4"	3'-10"	4'-8"	5'-8"	5'-3"	6'-8"	4'-8"	5'-6"	6'-11'	6'-10"	8'-0"	6'-4"	7'-2"	7'-10"	8'-7"

D, E AND F MADE AS REQUIRED.

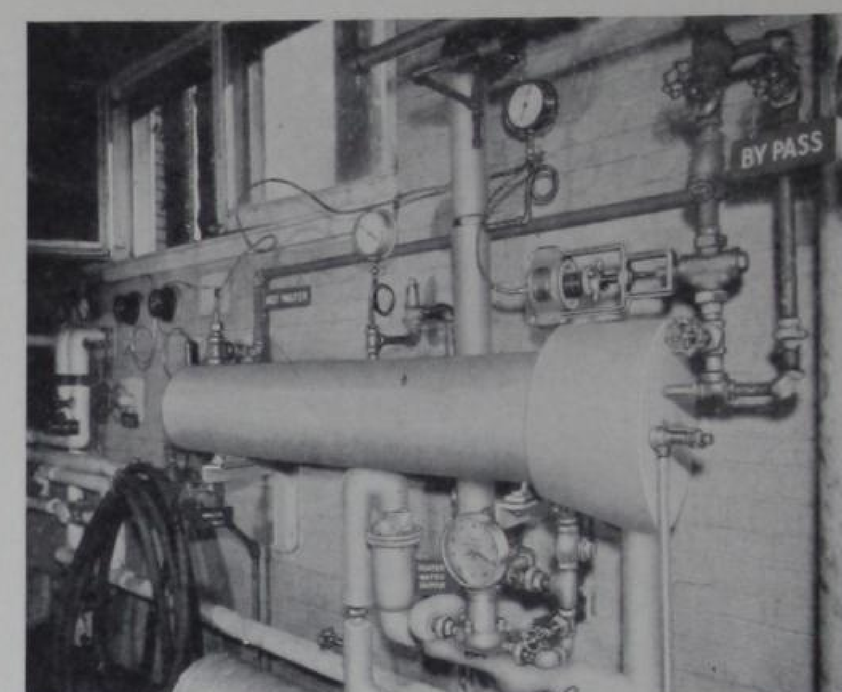
HEATER SIZES 14-20



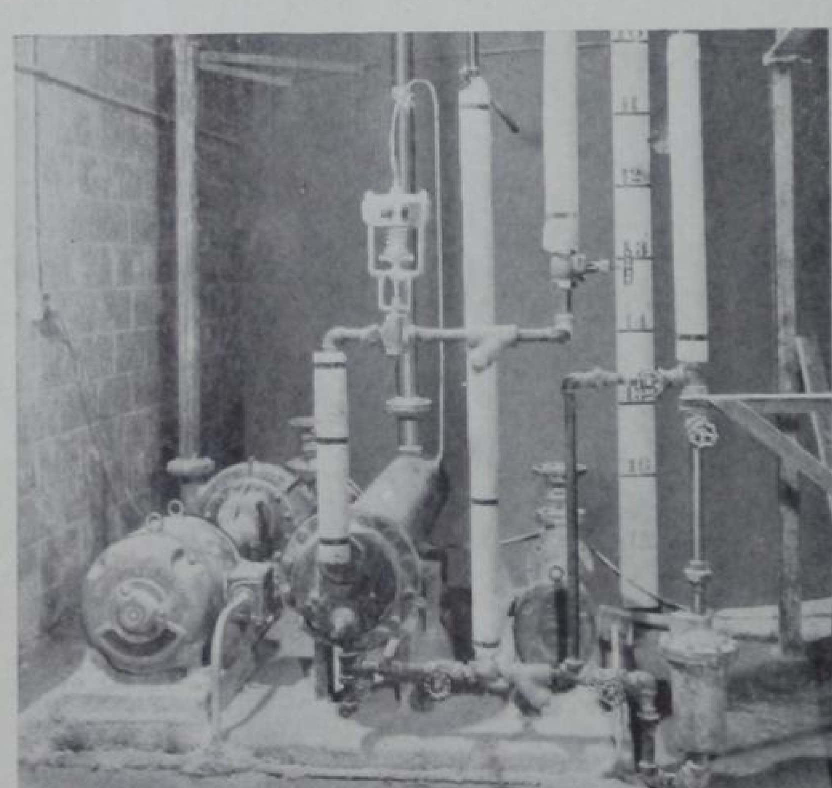
INSTALLATIONS



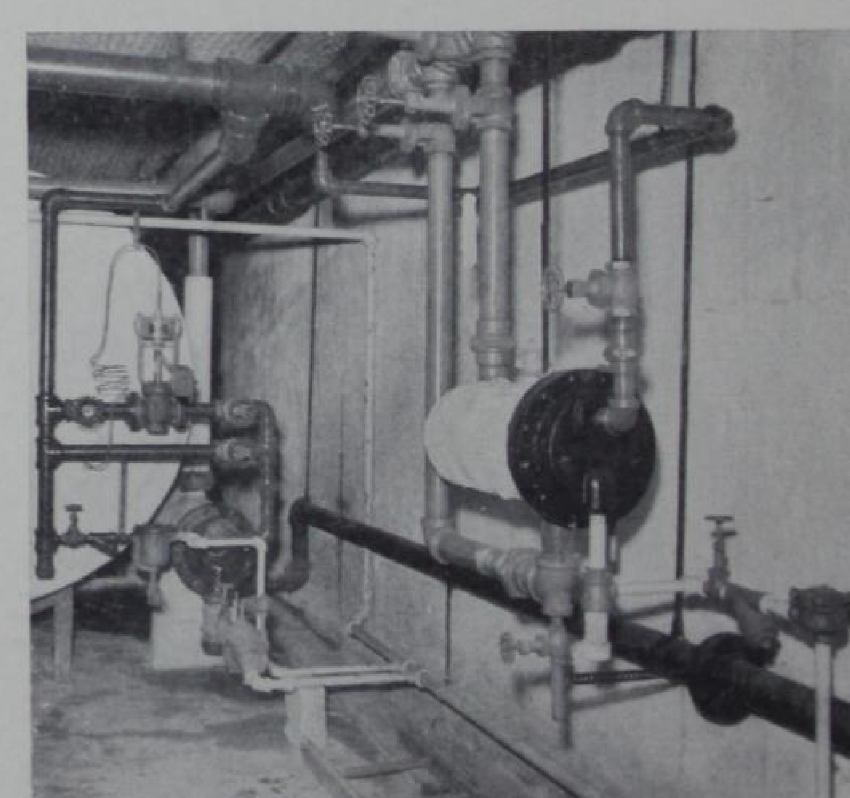
Whitlock-Darling Semi-Instantaneous Heater on laundry service, Ottawa General Hospital, Ottawa.



Whitlock-Darling Semi-Instantaneous Heater Installation at Standard Brands Limited, Ville La Salle.



Whitlock-Darling Semi-Instantaneous Heater, Sylphon Number 931 Temp. Regulator, Darling Class D Centrifugal Pumps, Turner & Newall (Canada) Ltd., Montreal.



Whitlock-Darling Semi-Instantaneous Booster Heater and Tank Heater with No. 930 Sylphon Temperature Regulator at Pritchard Baths, Winnipeg.

SYLPHON TEMP. REGULATORS

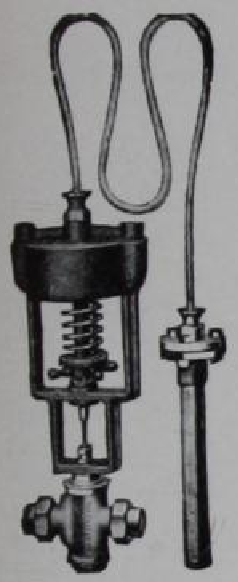


Fig. 1.

No. 931 Regulator

The No. 931 temperature regulator is largely used in industrial processes where one definite temperature is required from day to day. It is also widely used to control temperature of hot water storage tanks, etc.

The No. 12B bulb is standard and is dimensioned in table at right. It is made of copper and its fittings are of brass. Brass armor covers the flexible copper tubing between the bulb and regulator proper. This armored tubing is regularly furnished 8 feet long. Longer lengths available. Bulb and its fittings, as well as flexible tubing and its armor, can be furnished made of other metals.

This regulator is made in valve sizes ½" to 5", inclusive. Sizes ½" to 4", inclusive, are equipped with type "F" direct-acting valve. 5" size is equipped with type "E" direct-acting valve. Bronze trim supplied unless otherwise ordered. A reverse-acting valve will be furnished on order. Sizes ½" to 1½", inclusive, have screwed ends. Sizes 2" and above, flanged ends (125 lbs. A.S.A. Rating.)

Pressure Limits

The standard No. 931 regulator is not suitable where the pressure drop across valve exceeds the limits given in table at right. *A stainless steel trimmed valve should be used for pressures above 50 lbs., or for superheated steam.*

Installation

Bulb is to be inserted in the vessel so it will contact the liquid under control. A strainer should be installed ahead of the regulating valve. (Strainers are listed on back page).

Temperature Adjustment

This regulator can be set to control at any point within its temperature range by merely turning the adjustment wheel located just below the regulator head.

No. 931-OR Regulator

If it is necessary for the regulator to withstand, without damage, temperatures at the bulb of more than 20° above top end of the adjustable range, then the "Over-Run" feature must be supplied. This feature will protect against temperatures up to 100° above top of the range; and, in some cases, higher temperatures.

The "Over-Run" feature is not normally required for refrigerating ranges since the bulb temperature is normally lower than the (bellows) temperature at head of regulator.

When supplied with "Over-Run" feature, the regulator is designated as No. 931-OR. Valve sizes, pressure limits and temperature ranges same as for No. 931 except No. 931-OR in sizes 3" and above is not available with 60° temperature ranges; and, in any size with 80° or 120° ranges.

Temperature Ranges

Temperature ranges below are for No. 931 regulator. See description of No. 931-OR for its ranges. Order by range number.

40° Ranges		60°, 80° and 120° Ranges	
No.	Range	No.	Range
46-H	40°— 80° F.	46-K	40°—100° F.
50-H	60°—100° F.	50-K	60°—120° F.
56-H	90°—130° F.	56-K	90°—150° F.
58-H	100°—140° F.	58-K	100°—160° F.
62-H	120°—160° F.	62-K	120°—180° F.
66-H	140°—180° F.	66-K	140°—200° F.
70-H	160°—200° F.	70-K	160°—220° F.
74-H	180°—220° F.	74-K	180°—240° F.
76-H	190°—230° F.	76-K	190°—250° F.
80-H	210°—250° F.	80-K	210°—270° F.
82-H	220°—260° F.	82-K	220°—280° F.
84-H	230°—270° F.	84-K	230°—290° F.
87-H	245°—285° F.	87-K	245°—305° F.
93-H	275°—315° F.	93-K	275°—335° F.
96-H	290°—330° F.	96-K	290°—350° F.
		110-K	360°—420° F.
		110-P	360°—440° F.
		*110-WD	360°—480° F.

*Range 110-WD is not available for regulator sizes 2" and larger.

Dimensions

Valve Size, Inches	½	¾	1	1¼	1½	2	2½	3	4	5
*Pressure Limit, Pounds	250	250	250	250	225	85	65	55	40	30
Shipping Weight, Pounds	49	50	53	64	68	108	129	170	200	250
A	16 3/16	16 3/16	16 3/16	16 3/16	17¼	18 1/16	18 9/16	20⅜	21 7/16	25 9/16
B	14 3/16	14 3/16	14 3/16	14 3/16	14 3/16	14 3/16	14 3/16	15½	15½	15½
D	2	2	2⅝	2⅝	3 1/16					
E	5½	5¾	7	7⅝	8½					
K	7⅜	7⅜	7⅜	7⅜	7⅜	7⅜	7⅜	7⅜	7⅜	7⅜
L	2	2	2⅝	2⅝	3 1/16					
M						3⅞	4⅜	4⅞	5 15/16	10 1/16
N						7	7¾	8⅝	10¼	15⅞
O						3 1/16	3 9/16	3 13/16	4 11/16	9 5/16

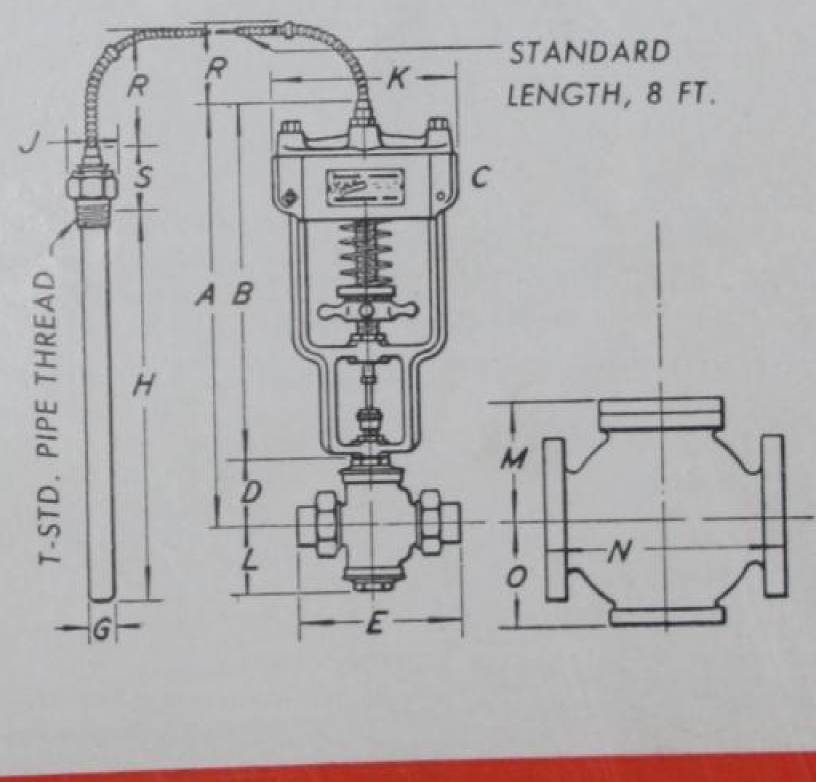
*Pressure drop across valve.

Standard bulb for temperature ranges beginning at 100°F. or above.

G	1	1	1	1	1	1	1	1	1	1¼
H	9	9	9	9	9	13	13	17	17	16
T	1-11½	1-11½	1-11½	1-11½	1-11½	1-11½	1-11½	1-11½	1-11½	1¼-11½

Standard bulb for temperature ranges beginning below 100°F. Under certain conditions, smaller bulbs may be used. Information on request.

G	1¼	1¼	1¼	1¼	1¼	1¼	1¼	1¼	1¼	1¼
H	24	24	24	24	24	24	24	24	24	30
T	1¼-11½	1¼-11½	1¼-11½	1¼-11½	1¼-11½	1¼-11½	1¼-11½	1¼-11½	1¼-11½	1¼-11½



DARLING "Y" TYPE STRAINERS

Pipe scale, sediment, bits of packing and other foreign matter is often the cause of damage to steam traps, pressure reducing valves, temperature regulators, etc. and unsatisfactory operation or even complete failure can frequently be attributed to pipe line impurities. Therefore the installation of a strainer is always recommended to protect such equipment.

Darling Series 29 Strainers are so constructed that they do not reduce the volume of fluid passing through them. The screen is placed with one end open to the inlet port and the other end open to the blow-off. The flow passes from inlet to outlet port through the screen so that all foreign matter is trapped in the cylinder screen, from where it is readily removed.

Adaptable to both horizontal and vertical downward flow pipe lines. In either position these strainers must be installed with the cap down.

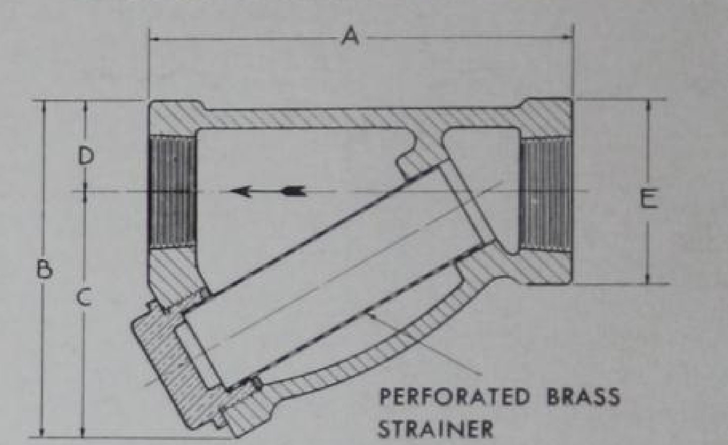
Darling "Y" Type Strainers have heavy cast iron bodies with perforated brass strainer cylinders, areas of which are several times larger than corresponding pipe sizes. Series 29 are screwed pattern made in sizes ½" to 2" inclusive. Standard cylinder screens have .040 inch diameter perforations 256 holes to the sq. in. Screens of monel metal can be supplied at extra charge. Fine mesh screens made of brass wire cloth can be furnished when specified.

Flanged Strainers are available in larger sizes.

Fig. 2—Darling Series 29 Dirt Strainers

Screwed Pattern — maximum working pressure 150 lbs. per sq. in.

Dimensions of Series 29 Dirt Strainers.



Size Inches	Symbol	A	B	C	D	E	Wei
½	292	3⅝	2⅞	2⅛	¾	1½	2
¾	293	4¼	3 7/16	2½	15/16	1⅞	3
1	294	5⅛	4	2 15/16	1 1/16	2⅛	4
1¼	295	5 13/16	4⅝	3⅜	1¼	2½	6
1½	296	6½	5 13/16	3¾	1 7/16	2⅞	8
2	298	8	6 9/16	4⅞	1 11/16	3⅜	13

All dimensions in inches and subject to slight variation. Weight in pounds

> **"There is hardly anything in the world that some man cannot make a little worse and sell a little cheaper, and the people who consider price only are this man's lawful prey."**
>
> **— Ruskin**

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DARLING

Bulletin No. 65

MANUAL OF HOT WATER HEATING EQUIPMENT

Type "R" Convertors

FOREWORD

This manual is prepared as an aid in the selection of equipment for those whose responsibility is the design of Hot Water Heating Systems.

The Whitlock-Darling Type "R" Convertor used in Hot Water Heating Systems, is as well know as the famous Class "D" Centrifugal Circulating Pump. The Whitlock-Darling Convertor and Cl "D" Pump, with such accessories as Sylphon Temperature Regulators and Webster Steam Trap offer a selection of equipment which not only provides undivided engineering responsibility, b also carries our standard guarantee of performance.

For the convenience of engineers and designers, we have compiled data on these associated products in this catalogue. We hope that all who have occasion to use this manual will find it a source of practical information.

WHITLOCK-DARLING TYPE "R" U-TUBE CONVERTORS

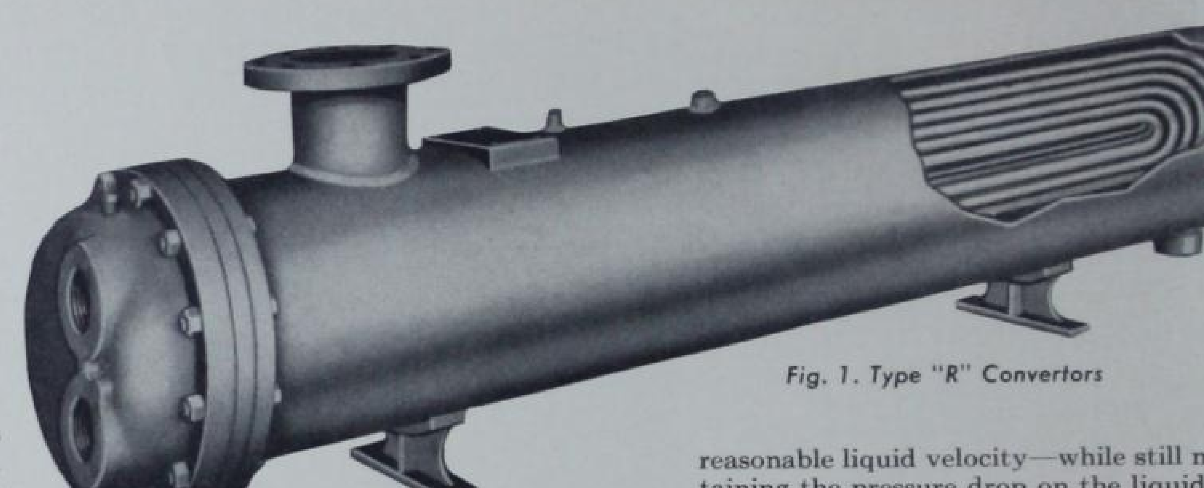


Fig. 1. Type "R" Convertors

The Convertors described in this manual are primarily designed for Forced Hot Water Heating Systems. They consist of a steel shell with removable heating section, both designed to operate at a maximum pressure of 100 p.s.i. The design is essentially that shown in Fig. 1.

HEATING SECTION

The heating section is fabricated of seamless drawn heavy gauge copper tubing assembled in the familiar 'U' bend pattern. Both ends of the tube are expanded into a heavy rolled steel tube sheet. This operation is automatically controlled by expanding machines that determine the exact amount of expansion necessary to assure a leak proof joint between tube and tube sheet.

The 'U' tube design makes a particularly compact tube bundle that can be readily removed from the shell when necessary. With this type of construction, the heating section is fixed to the shell at one end only so that any amount of expansion and contraction of shell or heating section is automatically taken care of independently of any other part.

SHELL

Shells, whether for low or high pressure steam, are made of steel. Where possible, the shell will be of standard steel pipe. Where pipe cannot be employed, especially on the larger convertors, the shell will be fabricated of steel plate. Shells 16" diameter and under have a steel welded-in flat plate rear cover while those 18" diameter and over are separate bolted-on dished covers.

Front heads or channels are ordinarily furnished of heavy cast iron.

In reading the capacity tables, the last figure of the size number is the nominal pipe size diameter. The actual outside diameter is given in the dimension tables.

While we have described steel shells, cast iron are available. These do not conform to the dimension tables on page 5, but capacity and dimension information can be furnished when required.

THE NUMBER OF PASSES

Determination of the number of passes (i.e., the number of times the liquid being heated travels the length of the heating section), is an important element of design but is never more than a means to an end.

With the proper size heater chosen for any given set of operating conditions, the next step is to adjust the relation between the heating surface and the cross sectional area of the liquid passages. This is necessary in order to obtain maximum effectiveness from the heating surface by maintaining reasonable liquid velocity—while still m taining the pressure drop on the liquid within permissible limits.

The number of passes required for a capacity and temperature rise is represe by the second number of the convertor in Table 1. The pressure drop through convertor at rated capacity is show Table 2.

DIMENSIONS

Reference to page 5 will show the esse dimensions of the convertors listed i capacity table on page 4. As a conven and time saver for the draftsman, Da Ready-Templates in $\frac{1}{8}''$, $\frac{1}{4}''$ and $\frac{1}{2}''$ on all sizes are available on request.

SUPPORTING CRADLES

Cast iron supporting cradles can be nished for all convertors. These ca supplied in either the floor or pipe mounting type.

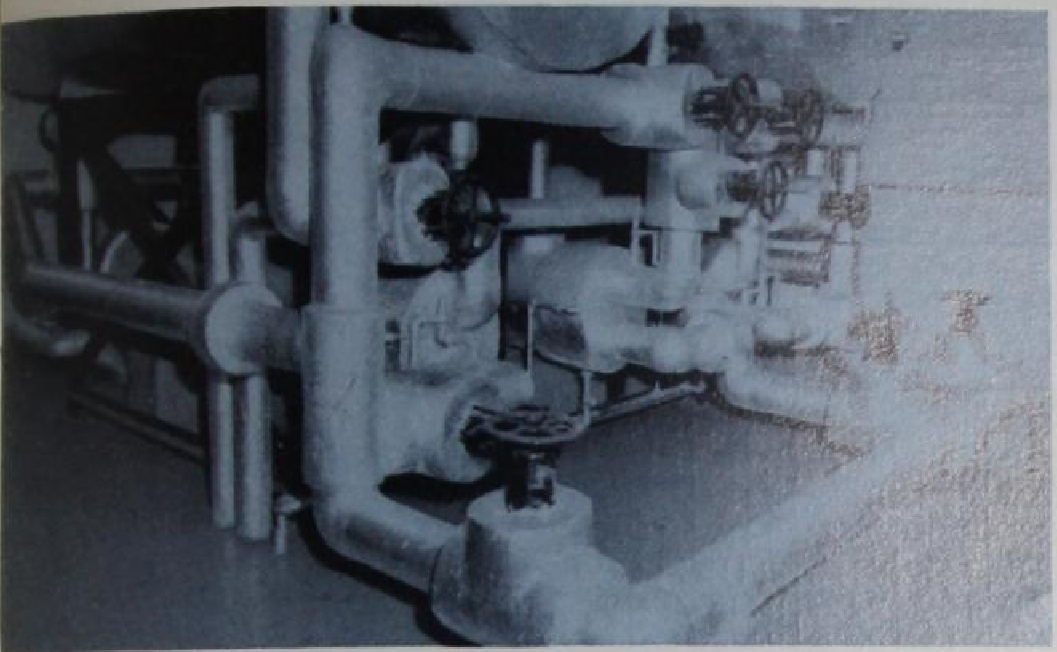
TYPICAL SPECIFICATION Furnish and install where indicated on plans—Whitlock-Darling Size .... Type " Convertor, having a capacity to heat .... U.S.G.P.M. of water from .... °F. to .... °F. when supplied wi sufficient steam at .... lbs. pressure and operating with forced circulation in the tube circuit. Convertor to cons of removable copper tube heating section fitted into a ...." diameter steel shell, length of which must not exce ...." overall.* Shell to be fitted with ...."(150 lb. standard flanged or screwed) steam inlet connection, ..." d connection and suitable relief valve connection.

Heating section fabricated of seamless drawn heavy gauge copper tubing assembled in 'U' bend pattern wi rolled steel tube sheet and cast iron front head having ...."inlet and outlet (150 lb. standard flanged or screwe connections. Pressure drop through tube circuit not to exceed .... p.s.i. at rated capacity.

Design pressure for tube and shell circuits to be 100 p.s.i. Cast iron cradles (shall or shall not) be furnished.

*NOTE: In order to provide sufficient space for tube removal.

Installations

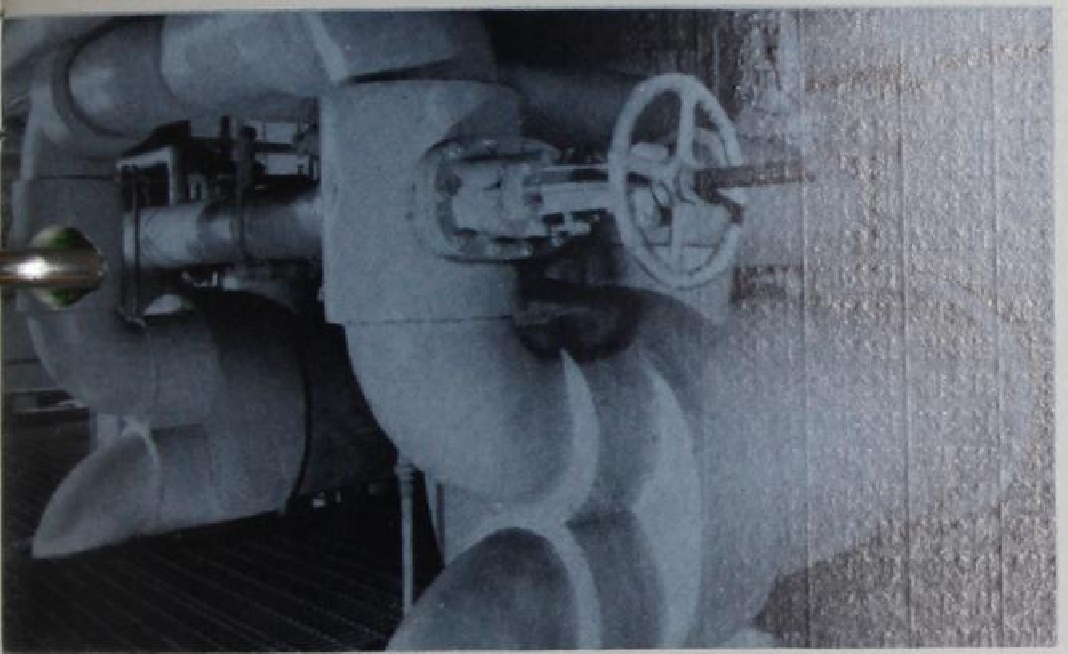


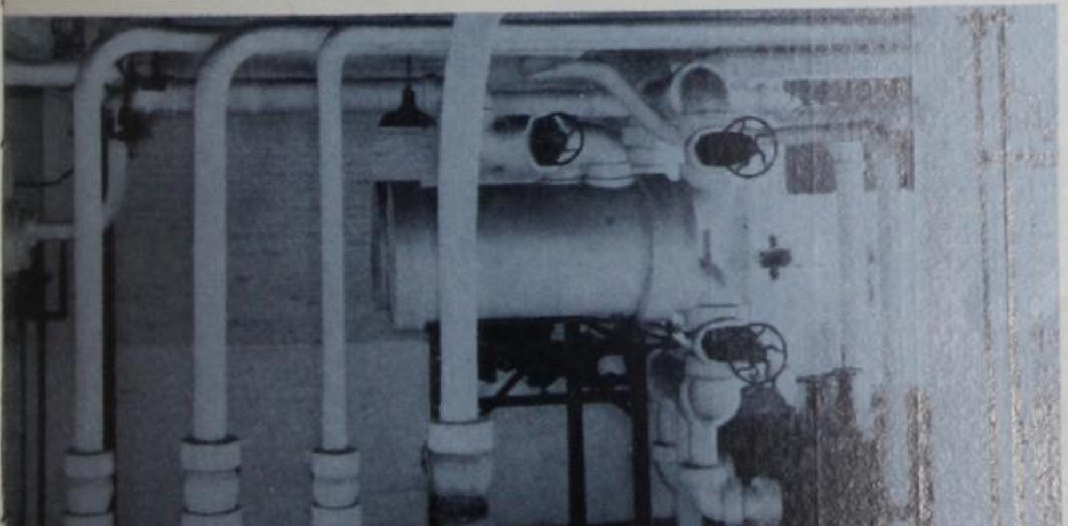
1. Deer Lodge Veterans' Hospital, Winnipeg, Manitoba, in which three #17 Whitlock-Darling Type "R" Two-Pass Convertors are installed.

2. Hospital for Sick Children, Toronto, Ontario. Photograph shows two #23½ Whitlock-Darling Type "R" Four-Pass Convertors on hot water heating system.

3. Hopital Hotel Dieu, St. Jerome, Quebec. Two #21 Whitlock-Darling Type "R" Two-Pass Convertors. Below are two Darling Class "B" Horizontal Split Case, Double Suction, Centrifugal Circulating Pumps with steam turbine prime movers. Both Convertors and Pumps are operating on the hot water heating system. Note also use of Sylphon Automatic Temperature Regulators and Webster Steam Traps.

4. Victoria General Hospital Nurses Home, Halifax. Two #15 Whitlock-Darling 2 Pass Convertors. (Two of four units shown) with Darling Class "B" Horizontal Split Case Centrifugal Circulating Pumps.





"Where Dependability is Vital, Darling Equipment is Specified"

WHITLOCK-DARLING
FOR FORCED CIRCU

Capacity Tables

NOTE: When showing these units on plans or in specifications please specify flow of water in US GPM. It is also important when placing an order that the capacity, temperature rise and steam pressure be given as well as the size of heater chosen. Remember that this table is based on forced circulation only—always state on your order the pump capacity.

Table 1—Capacities

Steam Press. Lbs. P.S.I.G.	Temp Rise of Water	FLOW IN U.S. GALLONS PER MINUTE																
		10	15	20	25	30	40	50	75	100	125	150	175	200	250	300	400	500
0	90°-120°F	2-2-4A	2-2-5A	3-2-5B	4-2-6A	5-2-6B	6-2-6B	8-2-8A	9-2-8B	10-2-10A	11-2-10B	12-2-10B	13-2-12B	13-2-12B	14-2-14A	15-2-14A	16-2-16A	17-2-18A
	120°-150°F	2-2-4A	3-2-5A	4-2-5B	6-2-6A	6-2-6B	7-2-6B	9-2-8A	10-2-8B	12-2-10A	13-2-10B	13-2-10B	14-2-12B	15-2-12B	16-2-14A	16-2-14A	18-2-16A	18½-2-18A
	160°-180°F	2-2-4A	4-2-5A	5-2-5B	6-2-6A	7-2-6B	8-2-6B	9-2-8A	11-2-8B	12-2-10A	13-2-10B	14-2-12A	15-2-12B	15-2-12B	16-2-14A	17-2-14A	18-2-16A	18½-2-18A
	160°-190°F	5-4-5A	7-4-6A	8-4-6A	9-4-8A	10-4-8B	11-4-8B	12-4-10A	14-4-12A	15-2-10A	16-2-12A	17-4-16A	17-4-16A	18-4-18A	19-4-20A	19½-4-20A	20½-4-24A	22-4-27A
	170°-200°F	7-4-5A	9-4-6A	9-4-6A	11-4-8A	12-4-8B	12-4-8B	13-4-10A	15-4-12A	16-4-14A	18-4-16A	18-4-16A	18½-4-16A	19½-4-18A	20½-4-20A	21-4-20A	22-4-24A	23-4-27A
2	90°-120°F	1-2-4A	2-2-5A	3-2-5B	4-2-6A	5-2-6B	6-2-6B	7-2-8A	9-2-8B	10-2-10A	11-2-10B	12-2-10B	13-2-12B	13-2-12B	14-2-14A	15-2-14A	16-2-16A	17-2-18A
	120°-150°F	2-2-4A	3-2-5A	4-2-5B	6-2-6A	6-2-6B	7-2-6B	9-2-8A	10-2-8B	11-2-10A	12-2-10B	13-2-10B	14-2-12B	14-2-12B	16-2-14A	16-2-14A	17-2-16A	18-2-18A
	160°-180°F	2-2-4A	4-2-5A	5-2-5B	6-2-6A	7-2-6B	8-2-6B	9-2-8A	11-2-8B	12-2-10A	13-2-10B	13-2-10B	14-2-12B	15-2-12B	16-2-14A	17-2-14A	18-2-16A	18½-2-18A
	160°-190°F	4-4-5A	6-4-6A	7-4-6A	9-4-8A	9-2-6B	10-4-8B	11-2-8A	13-4-12A	15-2-10A	16-2-12A	16-2-12A	17-4-16A	17-4-18A	18½-4-20A	19-4-20A	20-4-24A	21-4-27A
	170°-200°F	6-4-5A	8-4-6A	9-4-6A	10-4-8A	11-4-8B	11-4-8B	13-4-10A	14-4-12A	16-4-14A	17-4-16A	17-4-16A	18-4-16A	18½-4-18A	19½-4-20A	20-4-20A	21-4-24A	22½-4-27A
5	90°-120°F	1-2-4A	2-2-5A	3-2-5B	4-2-6A	5-2-6B	6-2-6B	7-2-8A	8-2-8B	10-2-10A	11-2-10B	11-2-10B	12-2-12B	13-2-12B	14-2-14A	14-2-14A	16-2-16A	17-2-18A
	120°-150°F	2-2-4A	3-2-5A	4-2-5B	5-2-6A	6-2-6B	7-2-6B	8-2-8A	9-2-8B	11-2-10A	12-2-10B	13-2-10B	14-2-12B	14-2-12B	15-2-14A	16-2-14A	17-2-16A	18-2-18A
	160°-180°F	2-2-4A	3-2-5A	4-2-5B	5-2-6A	6-2-6B	7-2-6B	9-2-8A	10-2-8B	11-2-10A	12-2-10B	13-2-10B	14-2-12B	14-2-12B	15-2-14A	16-2-14A	17-2-16A	18-2-18A
	160°-190°F	4-4-5A	5-2-5A	6-2-5B	8-4-8A	9-2-6B	9-2-6B	11-2-8A	12-2-8B	14-2-10A	15-2-12A	15-2-12A	16-2-12B	16-2-12B	18-4-20A	18-4-20A	19-4-24A	20-4-27A
	170°-200°F	4-4-5A	6-4-6A	7-4-6A	9-4-8A	9-2-6B	10-4-8B	12-4-10A	13-4-12A	15-2-10A	16-2-12A	16-2-12A	17-4-16A	18-4-18A	18½-4-20A	19-4-20A	20-4-24A	21½-4-27A
10	90°-120°F	1-2-4A	2-2-5A	2-2-5B	3-2-6A	4-2-6B	5-2-6B	6-2-8A	8-2-8B	9-2-10A	10-2-10B	11-2-10B	12-2-12B	12-2-12B	13-2-14A	14-2-14A	15-2-16A	16-2-18A
	120°-150°F	1-2-4A	2-2-5A	3-2-5B	4-2-6A	5-2-6B	6-2-6B	7-2-8A	9-2-8B	10-2-10A	11-2-10B	12-2-10B	13-2-12B	13-2-12B	14-2-14A	15-2-14A	16-2-16A	17-2-18A
	160°-180°F	1-2-4A	2-2-5A	3-2-5B	4-2-6A	5-2-6B	6-2-6B	7-2-8A	9-2-8B	10-2-10A	11-2-10B	12-2-10B	13-2-12B	13-2-12B	14-2-14A	15-2-14A	16-2-16A	17-2-18A
	160°-190°F	3-2-4A	4-2-5A	6-2-5B	7-2-6A	8-2-6B	9-2-6B	10-2-8A	11-2-8B	13-2-10A	14-2-12A	14-2-12A	15-2-12B	16-2-12B	17-2-14A	17-2-14A	18½-2-16A	19-2-18A
	170°-200°F	3-2-4A	5-2-5A	6-2-5B	7-2-6A	8-2-6B	9-2-6B	10-2-8A	12-2-8B	13-2-10A	14-2-12A	15-2-12A	16-2-12B	16-2-12B	17-2-14A	18-2-20A	19-4-24A	19½-2-18A
	180°-200°F	3-2-4A	5-2-5A	6-2-5B	7-2-6A	8-2-6B	9-2-6B	10-2-8A	12-2-8B	13-2-10A	14-2-12A	15-2-12A	16-2-12B	16-2-12B	17-2-14A	18-4-20A	19-4-24A	19½-2-18A
	190°-215°F	4-4-5A	6-4-6A	7-4-6A	8-4-8A	9-2-6B	10-4-8B	11-2-8A	13-4-12A	14-2-10A	16-2-12A	16-2-12A	17-2-16A	17-4-18A	18-4-20A	18½-4-20A	20-4-24A	21-4-27A
15	90°-120°F	1-2-4A	2-2-5A	2-2-5B	3-2-6A	4-2-6B	5-2-6B	6-2-8A	8-2-8B	9-2-10A	10-2-10B	11-2-10B	12-2-12B	12-2-12B	13-2-14A	14-2-14A	15-2-16A	16-2-18A
	120°-150°F	1-2-4A	2-2-5A	3-2-5B	4-2-6A	5-2-6B	6-2-6B	7-2-8A	9-2-8B	10-2-10A	11-2-10B	12-2-10B	13-2-12B	13-2-12B	14-2-14A	15-2-14A	16-2-16A	17-2-18A
	160°-180°F	1-2-4A	2-2-5A	3-2-5B	4-2-6A	5-2-6B	6-2-6B	7-2-8A	9-2-8B	10-2-10A	11-2-10B	11-2-10B	12-2-12B	13-2-12B	14-2-14A	15-2-14A	16-2-16A	17-2-18A
	160°-190°F	2-2-4A	4-2-5A	5-2-5B	6-2-6A	7-2-6B	8-2-6B	9-2-8A	11-2-8B	12-2-10A	13-2-10B	13-2-10B	14-2-12B	15-2-12B	16-2-14A	17-2-14A	18-2-16A	18½-2-18A
	170°-200°F	3-2-4A	4-2-5A	6-2-5B	7-2-6A	8-2-6B	9-2-6B	10-2-8A	11-2-8B	13-2-10A	14-2-12A	14-2-12A	15-2-12B	16-2-12B	17-2-14A	17-2-14A	18½-2-16A	19-2-18A
	180°-205°F	3-2-4A	4-2-5A	5-2-5B	6-2-6A	7-2-6B	8-2-6B	9-2-8A	11-2-8B	13-2-10A	13-2-10B	14-2-12A	15-2-12B	16-2-12B	16-2-14A	17-2-14A	18-2-16A	19-2-18A
	190°-215°F	3-2-4A	5-2-5A	6-2-5B	7-2-6A	8-2-6B	9-2-6B	10-2-8A	12-2-8B	13-2-10A	14-2-12A	15-2-12A	16-2-12B	16-2-12B	17-2-14A	18-4-20A	19-4-24A	19½-2-18A
25	90°-120°F	1-2-4A	1-2-5A	2-2-5B	3-2-6A	3-2-6B	4-2-6B	6-2-8A	7-2-8B	9-2-10A	9-2-10B	10-2-10B	11-2-12B	11-2-12B	13-2-14A	13-2-14A	14-2-16A	15-2-18A
	120°-150°F	1-2-4A	2-2-5A	2-2-5B	3-2-6A	4-2-6B	5-2-6B	6-2-8A	8-2-8B	9-2-10A	10-2-10B	11-2-10B	12-2-12B	12-2-12B	13-2-14A	14-2-14A	15-2-16A	16-2-18A
	160°-180°F	1-2-4A	2-2-5A	2-2-5B	3-2-6A	4-2-6B	5-2-6B	6-2-8A	8-2-8B	9-2-10A	10-2-10B	11-2-10B	12-2-12B	12-2-12B	13-2-14A	14-2-14A	15-2-16A	16-2-18A
	160°-190°F	2-2-4A	3-2-5A	4-2-5B	5-2-6A	6-2-6B	7-2-6B	8-2-8A	9-2-8B	11-2-10A	12-2-10B	13-2-10B	14-2-12B	14-2-12B	15-2-14A	16-2-14A	17-2-16A	18-2-18A
	160°-200°F	2-2-4A	3-2-5A	4-2-5B	6-2-6A	6-2-6B	7-2-6B	9-2-8A	10-2-8B	12-2-10A	13-2-10B	13-2-10B	14-2-12B	15-2-12B	16-2-14A	16-2-14A	17-2-16A	18-2-18A
	180°-200°F	2-2-4A	3-2-5A	4-2-5B	5-2-6A	6-2-6B	7-2-6B	9-2-8A	10-2-8B	11-2-10A	12-2-10B	13-2-10B	14-2-12B	14-2-12B	15-2-14A	16-2-14A	17-2-16A	18-2-18A
	190°-215°F	2-2-4A	4-2-5A	5-2-5B	6-2-6A	7-2-6B	8-2-6B	9-2-8A	10-2-8B	12-2-10A	13-2-10B	13-2-10B	14-2-12B	15-2-12B	16-2-14A	16-2-14A	18-2-16A	18½-2-18A
35	90°-120°F	1-2-4A	1-2-5A	2-2-5B	2-2-6A	3-2-6B	4-2-6B	5-2-8A	7-2-8B	8-2-10A	9-2-10B	10-2-10B	11-2-12B	11-2-12B	12-2-14A	13-2-14A	14-2-16A	15-2-18A
	120°-150°F	1-2-4A	2-2-5A	2-2-5B	3-2-6A	4-2-6B	5-2-6B	6-2-8A	8-2-8B	9-2-10A	10-2-10B	11-2-10B	12-2-12B	12-2-12B	13-2-14A	14-2-14A	15-2-16A	16-2-18A
	160°-180°F	1-2-4A	1-2-5A	2-2-5B	3-2-6A	3-2-6B	4-2-6B	6-2-8A	7-2-8B	9-2-10A	9-2-10B	10-2-10B	11-2-12B	11-2-12B	13-2-14A	13-2-14A	14-2-16A	15-2-18A
	160°-190°F	1-2-4A	2-2-5A	3-2-5B	4-2-6A	5-2-6B	6-2-6B	7-2-8A	9-2-8B	10-2-10A	11-2-10B	12-2-10B	13-2-12B	13-2-12B	14-2-14A	15-2-14A	16-2-16A	17-2-18A
	170°-200°F	2-2-4A	3-2-5A	4-2-5B	5-2-6A	6-2-6B	7-2-6B	8-2-8A	9-2-8B	11-2-10A	12-2-10B	13-2-10B	13-2-12B	14-2-12B	15-2-14A	16-2-14A	17-2-16A	18-2-18A
	180°-205°F	1-2-4A	2-2-5A	3-2-5B	4-2-6A	5-2-6B	6-2-6B	7-2-8A	9-2-8B	10-2-10A	11-2-10B	12-2-10B	13-2-12B	13-2-12B	14-2-14A	15-2-14A	16-2-16A	17-2-18A
	190°-215°F	2-2-4A	3-2-5A	4-2-5B	5-2-6A	6-2-6B	7-2-6B	8-2-8A	9-2-8B	11-2-10A	12-2-10B	13-2-10B	13-2-12B	14-2-12B	15-2-14A	16-2-14A	17-2-16A	18-2-18A
50	90°-120°F	1-2-4A	1-2-5A	2-2-5B	2-2-6A	3-2-6B	4-2-6B	5-2-8A	6-2-8B	8-2-10A	9-2-10B	9-2-10B	10-2-12B	11-2-12B	12-2-14A	13-2-14A	14-2-16A	15-2-18A
	120°-150°F	1-2-4A	1-2-5A	2-2-5B	2-2-6A	3-2-6B	4-2-6B	6-2-8A	7-2-8B	9-2-10A	9-2-10B	10-2-10B	11-2-12B	11-2-12B	13-2-14A	13-2-14A	14-2-16A	15-2-18A
	160°-180°F	1-2-4A	1-2-5A	2-2-5B	2-2-6A	3-2-6B	4-2-6B	5-2-8A	6-2-8B	8-2-10A	9-2-10B	9-2-10B	10-2-12B	11-2-12B	12-2-14A	13-2-14A	14-2-16A	15-2-18A
	160°-190°F	1-2-4A	2-2-5A	3-2-5B	4-2-6A	5-2-6B	6-2-6B	7-2-8A	8-2-8B	10-2-10A	11-2-10B	11-2-10B	12-2-12B	13-2-12B	14-2-14A	14-2-14A	16-2-16A	17-2-18A
	170°-200°F	1-2-4A	2-2-5A	3-2-5B	4-2-6A	5-2-6B	6-2-6B	7-2-8A	9-2-8B	10-2-10A	11-2-10B	12-2-10B	13-2-12B	13-2-12B	14-2-14A	15-2-14A	16-2-16A	17-2-18A
	180°-205°F	1-2-4A	2-2-5A	3-2-5B	4-2-6A	4-2-6B	6-2-6B	7-2-8A	8-2-8B	10-2-10A	11-2-10B	11-2-10B	12-2-12B	13-2-12B	14-2-14A	14-2-14A	16-2-16A	17-2-18A
	190°-215°F	1-2-4A	2-2-5A	3-2-5B	4-2-6A	5-2-6B	6-2-6B	7-2-8A	9-2-8B	10-2-10A	11-2-10B	12-2-10B	13-2-12B	13-2-12B	14-2-14A	15-2-14A	16-2-16A	17-2-18A

REVISED

CAPACITY TABLES

FOR

orced irculation

F.C. CONVERTORS Type "R"

20 o F Temp. Rise

MAY 1954

DARLING

Bulletin No. 65

CAPACITY TABLES

P.D. - PRESSURE DROP THROUGH CONVERTOR IN FEET OF WATER. **M.B.H. - U.S. G.P.M. × 10**

STEAM PRESS. LBS. P.S.I.G.	TEMP. RISE OF WATER	FLOW IN U.S. GALLONS PER MINUTE																			
		15	20	25	30	40	50	60	70	80	90	100	125	150	175	200	225	250	300	400	500
0	120° - 140° F	1-2-4A	1-2-4A	2-2-5B	3-2-5B	4-2-6B	5-2-6B	5-2-6B	7-2-8B	7-2-8B	8-2-8B	8-2-8B	10-2-10B	10-2-10B	10-2-10B	10-2-10B	12-2-12B	12-2-12B	13-2-12B	14-2-14A	15-2-16A
	P.D.	2.3	3.8	2.2	3.4	1.8	2.7	3.8	1.4	1.8	2.3	2.7	1.4	1.9	2.4	3.0	1.7	2.0	3.1	3.3	2.9
	130° - 150° F	1-2-4A	2-2-4A	3-2-5B	3-2-5B	5-2-6B	6-2-6B	6-2-6B	8-2-8B	8-2-8B	8-2-8B	9-2-8B	10-2-10B	11-2-10B	11-2-10B	11-2-10B	13-2-12B	13-2-12B	13-2-12B	14-2-14A	15-2-16A
	P.D.	2.3	4.5	2.5	3.3	1.9	3.0	4.2	1.5	1.9	2.3	3.0	1.4	2.0	2.6	3.2	1.9	2.2	3.1	3.2	2.9
	160° - 180° F	3-2-4A	3-2-4A	5-2-5B	6-2-5B	7-2-6B	8-2-6B	8-2-6B	10-2-8B	10-2-8B	11-2-8B	11-2-8B	13-2-10B	13-2-10B	13-2-10B	13-2-10B	14-2-12A	14-2-12A	16-2-12B	16-2-14A	18-2-16A
	P.D.	3.1	5.0	2.9	4.6	2.3	3.6	5.0	1.8	2.3	3.1	3.7	1.8	2.4	3.1	3.8	4.0	4.8	4.2	3.9	3.9
	170° - 190° F	5-2-5B	6-2-5B	6-2-5B	8-2-6B	9-2-6B	9-2-6B	9-2-6B	11-2-8B	12-2-8B	12-2-8B	12-2-8B	14-2-10A	14-2-10A	14-2-10A	15-2-12A	16-2-12B	16-2-12B	17-2-14A	18½-2-16A	18½-2-16A
	P.D.	1.2	2.3	3.4	1.6	2.9	4.2	5.9	2.0	2.8	3.5	4.1	2.6	3.4	4.4	3.6	2.6	3.1	2.7	2.9	4.2
	180° - 200° F	6-4-6A	7-4-6A	9-2-6B	10-4-8B	10-4-8B	12-4-10A	12-4-10A	13-4-12A	13-4-12A	15-2-10A	15-2-10A	16-2-12A	16-2-12A	17-4-16A	18-4-18A	18-4-18A	18-4-18A	19-4-20A	20-4-24A	21½-4-27A
	P.D.	3.2	5.8	1.3	3.6	5.8	4.3	5.8	3.6	4.4	1.6	2.0	2.0	2.8	5.4	3.6	4.3	5.1	4.7	4.6	3.9
2	120° - 140° F	1-2-4A	1-2-4A	2-2-5B	2-2-5B	4-2-6B	4-2-6B	5-2-6B	6-2-8B	7-2-8B	7-2-8B	7-2-8B	9-2-10B	9-2-10B	10-2-10B	10-2-10B	11-2-12B	11-2-12B	12-2-12B	13-2-14A	14-2-16A
	P.D.	2.3	3.8	2.2	3.0	1.8	2.5	3.8	1.3	1.8	2.2	2.5	1.3	1.7	2.4	3.0	1.6	1.9	2.8	3.0	2.7
	130° - 150° F	1-2-4A	1-2-4A	2-2-5B	2-2-5B	4-2-6B	5-2-6B	5-2-6B	7-2-8B	7-2-8B	7-2-8B	8-2-8B	9-2-10B	10-2-10B	10-2-10B	10-2-10B	12-2-12B	12-2-12B	12-2-12B	13-2-14A	14-2-16A
	P.D.	2.3	3.8	2.2	3.0	1.8	2.7	3.7	1.4	1.8	2.1	2.7	1.3	1.8	2.4	2.9	1.7	2.0	2.7	2.9	2.7
	160° - 180° F	2-2-4A	2-2-4A	4-2-5B	4-2-5B	6-2-6B	7-2-6B	7-2-6B	9-2-8B	9-2-8B	9-2-8B	10-2-8B	12-2-10B	12-2-10B	12-2-10B	12-2-10A	14-2-12B	14-2-12B	14-2-12B	16-2-14A	17-2-16A
	P.D.	2.6	4.3	2.6	3.6	2.0	3.3	4.5	1.6	2.0	2.5	3.3	1.6	2.1	2.7	4.3	2.0	2.4	3.2	3.9	3.5
	170° - 190° F	3-2-4A	3-2-4A	5-2-5B	6-2-5B	7-2-6B	8-2-6B	8-2-6B	10-2-8B	10-2-8B	11-2-8B	11-2-8B	13-2-10B	13-2-10B	13-2-10B	13-2-10B	14-2-12A	14-2-12A	16-2-12B	17-2-14A	18-2-16A
	P.D.	3.0	5.0	2.8	4.6	2.2	3.6	5.0	1.8	2.3	3.1	3.6	1.8	2.4	3.1	3.8	4.0	4.8	4.2	4.3	3.8
	180° - 200° F	6-2-5B	6-2-5B	6-2-5B	8-2-6B	9-2-6B	9-2-6B	11-2-8B	12-2-8B	12-2-8B	12-2-8B	12-2-8B	14-2-10A	14-2-10A	15-2-10A	16-2-12B	16-2-12B	16-2-12B	18-2-16A	18½-2-16A	19½-2-18A
	P.D.	1.4	2.3	3.3	1.6	2.9	4.2	1.6	2.3	2.8	3.4	4.0	2.6	3.4	4.9	2.1	2.5	3.0	1.6	2.9	2.9
	190° - 210° F	7-4-6A	10-4-8B	10-4-8B	10-4-8B	12-4-10A	12-4-10A	13-4-12A	15-2-10A	14-4-12A	16-2-12A	16-2-12A	17-4-16A	17-4-16A	17-4-16A	18½-4-18A	18½-4-18A	18½-4-18A	19½-4-20A	20½-4-24A	22-4-27A
	P.D.	3.6	1.8	2.6	3.6	3.0	4.3	2.8	1.2	5.0	1.2	1.4	3.1	4.2	5.4	3.9	4.6	5.5	5.0	4.8	4.1
5	120° - 140° F	1-2-4A	1-2-4A	2-2-5B	2-2-5B	3-2-6B	3-2-6B	4-2-6B	6-2-8B	6-2-8B	6-2-8B	6-2-8B	8-2-10A	9-2-10B	9-2-10B	9-2-10B	10-2-12B	11-2-12B	11-2-12B	12-2-14A	14-2-16A
	P.D.	2.3	3.8	2.2	3.0	1.6	2.4	3.5	1.3	1.6	2.0	2.4	1.5	1.7	2.2	2.7	1.5	1.9	2.6	2.7	2.7
	130° - 150° F	1-2-4A	1-2-4A	2-2-5B	2-2-5B	3-2-6B	4-2-6B	4-2-6B	6-2-8B	6-2-8B	7-2-8B	7-2-8B	9-2-10B	9-2-10B	9-2-10B	9-2-10B	11-2-12B	11-2-12B	11-2-12B	13-2-14A	14-2-16A
	P.D.	2.3	3.8	2.2	3.0	1.6	2.5	3.5	1.3	1.6	2.1	2.5	1.3	1.7	2.2	2.7	1.6	1.9	2.6	2.9	2.7
	160° - 180° F	1-2-4A	2-2-4A	3-2-5B	3-2-5B	5-2-6B	6-2-6B	6-2-6B	8-2-8B	8-2-8B	9-2-8B	9-2-8B	10-2-10B	11-2-10B	11-2-10B	11-2-10B	13-2-12B	13-2-12B	13-2-12B	14-2-14A	16-2-16A
	P.D.	2.2	4.3	2.4	3.2	1.8	2.9	4.1	1.5	1.8	2.5	2.9	1.3	1.9	2.5	3.1	1.8	2.2	2.9	3.1	3.1
	170° - 190° F	2-2-4A	2-2-4A	4-2-5B	4-2-5B	6-2-6B	7-2-6B	7-2-6B	9-2-8B	9-2-8B	9-2-8B	9-2-8B	11-2-10B	12-2-10B	12-2-10B	12-2-10B	14-2-12B	14-2-12B	14-2-12B	16-2-14A	16-2-16A
	P.D.	2.6	4.3	2.6	3.5	2.0	3.2	4.5	1.6	2.0	2.5	2.9	1.4	2.1	2.7	3.3	2.0	2.4	3.2	3.8	3.1
	180° - 200° F	3-2-4A	3-2-4A	5-2-5B	5-2-5B	7-2-6B	8-2-6B	8-2-6B	10-2-8B	10-2-8B	10-2-8B	11-2-8B	13-2-10B	13-2-10B	13-2-10B	13-2-10B	14-2-12A	14-2-12A	15-2-12B	16-2-14A	18-2-16A
	P.D.	3.0	4.9	2.8	3.8	2.2	3.5	4.9	1.8	2.2	2.7	3.6	1.8	2.4	3.0	3.8	3.9	4.7	3.5	3.8	3.8
	190° - 210° F	6-2-5B	6-2-5B	6-2-5B	8-2-6B	9-2-6B	9-2-6B	9-2-6B	11-2-8B	12-2-8B	12-2-8B	12-2-8B	14-2-10A	14-2-10A	14-2-10A	15-2-12A	16-2-12B	16-2-12B	17-2-14A	18½-2-16A	18½-2-16A
	P.D.	1.4	2.3	3.3	1.5	2.9	4.1	5.7	2.0	2.8	3.4	4.0	2.5	3.4	4.3	3.6	2.5	3.0	2.6	2.8	4.1
	200° - 220° F	7-4-6A	10-4-8B	10-4-8B	10-4-8B	12-4-10A	12-4-10A	13-4-12A	15-2-10A	15-2-10A	16-2-12A	16-2-12A	17-4-16A	17-4-16A	17-4-16A	18½-4-18A	18½-4-18A	18½-4-18A	19½-4-20A	20½-4-24A	22-4-27A
	P.D.	3.5	1.8	2.6	3.5	2.9	4.2	2.7	1.1	1.3	1.2	1.4	3.1	4.1	5.3	3.9	4.6	5.5	5.0	4.8	4.0

CAPACITY TABLES

P.D. - PRESSURE DROP THROUGH CONVERTOR IN FEET OF WATER.

STEAM PRESS. LBS. P.S.I.G.	TEMP. RISE OF WATER	FLOW IN U.S. GALLONS PER MINUTE																			
		15	20	25	30	40	50	60	70	80	90	100	125	150	175	200	225	250	300	400	500
10	120°-140° F	1-2-4A	1-2-4A	2-2-5B	2-2-5B	3-2-6B	3-2-6B	3-2-6B	6-2-8B	6-2-8B	6-2-8B	6-2-8B	8-2-10A	8-2-10A	8-2-10A	8-2-10A	10-2-12B	10-2-12B	10-2-12B	12-2-14A	14-2-16A
	P.D.	2.3	3.8	2.2	3.0	1.6	2.4	3.3	1.3	1.6	2.0	2.4	1.5	2.0	2.5	3.2	1.5	1.8	2.4	2.7	2.7
	130°-150° F	1-2-4A	1-2-4A	2-2-5B	2-2-5B	3-2-6B	3-2-6B	3-2-6B	6-2-8B	6-2-8B	6-2-8B	6-2-8B	8-2-10A	8-2-10A	9-2-10B	9-2-10B	10-2-12B	10-2-12B	11-2-12B	12-2-14A	14-2-16A
	P.D.	2.3	3.8	2.2	3.0	1.6	2.3	3.2	1.3	1.6	2.0	2.3	1.4	1.9	2.2	2.7	1.5	1.8	2.6	2.7	2.7
	160°-180° F	1-2-4A	1-2-4A	2-2-5B	2-2-5B	4-2-6B	5-2-6B	5-2-6B	7-2-8B	7-2-8B	7-2-8B	8-2-8B	9-2-10B	10-2-10B	10-2-10B	10-2-10B	12-2-12B	12-2-12B	12-2-12B	13-2-14A	14-2-16A
	P.D.	2.2	3.6	2.1	2.8	1.7	2.6	3.6	1.4	1.7	2.0	2.6	1.2	1.8	2.3	2.8	1.6	1.9	2.6	2.8	2.6
	170°-190° F	1-2-4A	2-2-4A	3-2-5B	3-2-5B	5-2-6B	6-2-6B	6-2-6B	8-2-8B	8-2-8B	8-2-8B	9-2-8B	10-2-10B	11-2-10B	11-2-10B	11-2-10B	13-2-12B	13-2-12B	13-2-12B	14-2-14A	15-2-16A
	P.D.	2.2	4.2	2.3	3.2	1.8	2.9	4.0	1.4	1.8	2.2	2.9	1.3	1.9	2.4	3.0	1.8	2.1	2.9	3.0	2.7
	180°-200° F	2-2-4A	2-2-4A	3-2-5B	4-2-5B	6-2-6B	6-2-6B	6-2-6B	9-2-8B	9-2-8B	9-2-8B	9-2-8B	11-2-10B	11-2-10B	12-2-10B	12-2-10B	13-2-12B	13-2-12B	14-2-12B	15-2-14A	16-2-16A
	P.D.	2.6	4.2	2.3	3.5	2.0	2.9	4.0	1.6	2.0	2.4	2.9	1.4	1.9	2.6	3.3	1.8	2.1	3.2	3.3	2.7
	190°-210° F	2-2-4A	3-2-4A	4-2-5B	5-2-5B	7-2-6B	7-2-6B	8-2-6B	9-2-8B	10-2-8B	10-2-8B	10-2-8B	12-2-10B	13-2-10B	13-2-10B	13-2-10B	14-2-12B	14-2-12B	15-2-12B	16-2-14A	17-2-16A
	P.D.	2.5	4.8	2.5	3.8	2.2	3.1	4.8	1.6	2.2	2.7	3.2	1.5	2.4	3.0	3.8	1.9	2.3	3.4	3.8	3.4
	200°-220° F	5-2-5B	6-2-5B	6-2-5B	6-2-5B	8-2-6B	9-2-6B	9-2-6B	11-2-8B	11-2-8B	11-2-8B	12-2-8B	13-2-10B	13-2-10A	14-2-10A	14-2-10A	15-2-12A	15-2-12A	16-2-12B	17-2-14A	18½-2-16A
	P.D.	1.2	2.3	3.3	4.4	2.4	4.1	5.7	2.0	2.5	3.0	3.9	1.7	3.0	4.3	5.5	4.3	5.1	4.0	4.2	4.0
15	120°-140° F	1-2-4A	1-2-4A	2-2-5B	2-2-5B	3-2-6B	3-2-6B	3-2-6B	6-2-8B	6-2-8B	6-2-8B	6-2-8B	8-2-10A	8-2-10A	8-2-10A	8-2-10A	10-2-12B	10-2-12B	10-2-12B	12-2-14A	14-2-16A
	P.D.	2.3	3.8	2.2	3.0	1.6	2.4	3.3	1.3	1.6	2.0	2.4	1.5	2.0	2.5	3.2	1.5	1.8	2.4	2.7	2.7
	130°-150° F	1-2-4A	1-2-4A	2-2-5B	2-2-5B	3-2-6B	3-2-6B	3-2-6B	6-2-8B	6-2-8B	6-2-8B	6-2-8B	8-2-10A	8-2-10A	8-2-10A	8-2-10A	10-2-12B	10-2-12B	10-2-12B	12-2-14A	14-2-16A
	P.D.	2.3	3.8	2.2	3.0	1.6	2.3	3.2	1.3	1.6	2.0	2.3	1.4	1.9	2.5	3.1	1.5	1.8	2.4	2.7	2.7
	160°-180° F	1-2-4A	1-2-4A	2-2-5B	2-2-5B	3-2-6B	4-2-6B	4-2-6B	6-2-8B	6-2-8B	6-2-8B	7-2-8B	9-2-10B	9-2-10B	9-2-10B	10-2-10B	11-2-12B	11-2-12B	12-2-12B	13-2-14A	14-2-16A
	P.D.	2.2	3.6	2.1	2.8	1.6	2.4	3.4	1.3	1.6	1.9	2.4	1.2	1.6	2.1	2.8	1.5	1.8	2.6	2.8	2.6
	170°-190° F	1-2-4A	1-2-4A	2-2-5B	2-2-5B	4-2-6B	5-2-6B	5-2-6B	7-2-8B	7-2-8B	7-2-8B	8-2-8B	9-2-10B	10-2-10B	10-2-10B	10-2-10B	12-2-12B	12-2-12B	12-2-12B	13-2-14A	14-2-16A
	P.D.	2.2	3.6	2.1	2.8	1.7	2.5	3.5	1.3	1.7	2.0	2.6	1.2	1.7	2.2	2.8	1.6	1.9	2.6	2.8	2.5
	180°-200° F	1-2-4A	2-2-4A	3-2-5B	3-2-5B	5-2-6B	5-2-6B	6-2-6B	8-2-8B	8-2-8B	8-2-8B	8-2-8B	10-2-10B	10-2-10B	11-2-10B	11-2-10B	13-2-12B	13-2-12B	13-2-12B	14-2-14A	15-2-16A
	P.D.	2.1	4.2	2.3	3.1	1.8	2.5	4.0	1.4	1.8	2.1	2.5	1.3	1.7	2.4	3.0	1.8	2.1	2.9	3.0	2.7
	190°-210° F	2-2-4A	2-2-4A	3-2-5B	4-2-5B	6-2-6B	6-2-6B	6-2-6B	9-2-8B	9-2-8B	9-2-8B	9-2-8B	11-2-10B	11-2-10B	12-2-10B	12-2-10B	13-2-12B	13-2-12B	14-2-12B	15-2-14A	16-2-16A
	P.D.	2.5	4.2	2.3	3.4	2.0	2.8	3.9	1.6	2.0	2.4	2.8	1.4	1.9	2.6	3.2	1.8	2.1	3.1	3.2	3.0
	200°-220° F	2-2-4A	3-2-4A	4-2-5B	5-2-5B	7-2-6B	7-2-6B	7-2-6B	9-2-8B	10-2-8B	10-2-8B	10-2-8B	12-2-10B	12-2-10B	13-2-10B	13-2-10B	14-2-12B	14-2-12B	15-2-12B	16-2-14A	17-2-16A
	P.D.	2.5	4.8	2.5	3.7	2.2	3.1	4.3	1.6	2.2	2.7	3.1	1.5	2.0	3.0	3.7	1.9	2.3	3.4	3.7	3.3

DARLING

DARLING BROS. LTD.
MONTREAL QUEBEC

MAY 1954

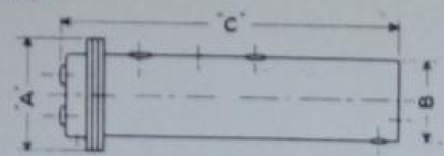
ASK US ABOUT WEBSTER CF3 CONTROL

FOR HOT WATER HEATING SYSTEMS.

'R" U-TUBE CONVERTORS

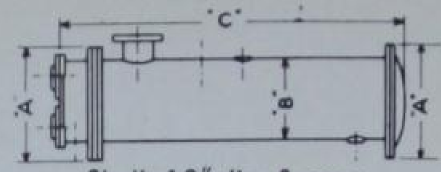
IOT WATER HEATING SYSTEMS

ign Data



Shells 16" dia. and under— welded-in end plate.

All connections 3" and over F. & D., 150/ U.S. Std. Design Pressure Tube & Shell Circuits 100 PSIG.



Shells 18" dia. & over —separate cover.

Table 2—Dimension & Pressure Drop Data

Flow in U.S.G.P.M.	10	15	20	25	30	40	50	75	100	125	150	175	200	250	300	400	500
Water Connections	1"	1¼"	1½"	1½"	2"	2"	2½"	3"	3"	4"	4"	4"	4"	5"	5"	6"	6"
Max. size Steam Connection	1¼"	1¼"	1½"	2"	2"	2½"	2½"	3"	4"	4"	4"	5"	5"	6"	6"	6"	6"
Max size Condensate Connection	1"	1"	1¼"	1½"	1½"	1½"	1½"	1½"	2"	2"	2"	2½"	2½"	2½"	2½"	2½"	2½"
Heater Size	1-2-4A	1-2-5A	2-2-5B	2-2-6A	3-2-6B	4-2-6B	5-2-8A	6-2-8B	8-2-10A	9-2-10B	9-2-10B	10-2-12B	11-2-12B	12-2-14A	13-2-14A	14-2-16A	15-2-18A
Flange Size "A"	8¼"	9¼"	9¼"	10¼"	10¼"	10¼"	13¼"	13¼"	16¼"	16¼"	16¼"	16¼"	16¼"	19¼"	19¼"	22¼"	23¼"
Shell Size "B"	4½"	5½"	5½"	6⅝"	6⅝"	6⅝"	8⅝"	8⅝"	10¾"	10¾"	10¾"	12¾"	12¾"	14"	14"	16"	18"
Overall Length "C"	2'-8"	2'-1"	2'-6"	1'-11"	2'-0"	2'-5"	1'-10"	2'-0"	2'-0"	2'-11"	2'-11"	2'-6"	3'-0"	3'-1"	3'-10"	3'-9"	3'-7"
Pressure Drop (Lbs./□")	0.48	0.58	0.68	0.49	0.42	0.89	0.45	0.74	0.41	0.58	0.86	0.36	0.58	0.50	0.85	0.83	0.93
Heater Size	2-2-4A	2-2-5A	3-2-5B	3-2-6A	4-2-6B	5-2-6B	6-2-8A	7-2-8B	9-2-10A	10-2-10B	10-2-10B	11-2-12B	12-2-12B	13-2-14A	14-2-14A	15-2-16A	16-2-18A
Flange Size "A"	8¼"	9¼"	9¼"	10¼"	10¼"	10¼"	13¼"	13¼"	16¼"	16¼"	16¼"	16¼"	16¼"	19¼"	19¼"	22¼"	23¼"
Shell Size "B"	4½"	5½"	5½"	6⅝"	6⅝"	6⅝"	8⅝"	8⅝"	10¾"	10¾"	10¾"	12¾"	12¾"	14"	14"	16"	18"
Overall Length "C"	3'-10"	3'-0"	3'-3"	2'-4"	2'-5"	2'-9"	2'-4"	2'-5"	2'-6"	3'-6"	3'-6"	3'-0"	3'-6"	3'-10"	4'-7"	4'-4"	4'-6"
Pressure Drop (Lbs./□")	0.58	0.67	0.79	0.57	0.49	1.01	0.51	0.84	0.48	0.66	0.98	0.43	0.69	0.59	1.00	0.98	1.04
Heater Size	3-2-4A	3-2-5A	4-2-5B	4-2-6A	5-2-6B	6-2-6B	7-2-8A	8-2-8B	10-2-10A	11-2-10B	11-2-10B	12-2-12B	13-2-12B	14-2-14A	15-2-14A	16-2-16A	17-2-18A
Flange Size "A"	8¼"	9¼"	9¼"	10¼"	10¼"	10¼"	13¼"	13¼"	16¼"	16¼"	16¼"	16¼"	16¼"	19¼"	19¼"	22¼"	23¼
Shell Size "B"	4½"	5½"	5½"	6⅝"	6⅝"	6⅝"	8⅝"	8⅝"	10¾"	10¾"	10¾"	12¾"	12¾"	14"	14"	16"	18"
Overall Length "C"	5'-0"	3'-11"	4'-0"	3'-0"	2'-9"	3'-7"	2'-10"	2'-10"	2'-11"	4'-3"	4'-3"	3'-6"	4'-5"	4'-7"	5'-4"	5'-5"	5'-4"
Pressure Drop (Lbs./□")	0.69	0.76	0.89	0.65	0.56	1.13	0.57	0.93	0.55	0.74	1.10	0.51	0.80	0.68	1.15	1.13	1.15
Heater Size	4-4-5A	4-2-5A	5-2-5B	5-2-6A	6-2-6B	7-2-6B	8-2-8A	9-2-8B	11-2-10A	12-2-10B	12-2-10B	13-2-12B	14-2-12B	15-2-14A	16-2-14A	17-2-16A	18-2-18A
Flange Size "A"	9¼"	9¼"	9¼"	10¼"	10¼"	10¼"	13¼"	13¼"	16¼"	16¼"	16¼"	16¼"	16¼"	19¼"	19¼"	22¼"	23¼"
Shell Size "B"	5½"	5½"	5½"	6⅝"	6⅝"	6⅝"	8⅝"	8⅝"	10¾"	10¾"	10¾"	12¾"	12¾"	14"	14"	16"	18"
Overall Length "C"	3'-1"	4'-10"	4'-8"	3'-6"	3'-7"	4'-4"	3'-3"	3'-7"	3'-7"	5'-0"	5'-0"	4'-5"	5'-4"	5'-4"	6'-9"	6'-7"	6'-4"
Pressure Drop (Lbs./□")	1.46	0.85	0.99	0.73	0.63	1.25	0.63	1.02	0.62	0.82	1.22	0.59	0.91	0.77	1.30	1.28	1.26
Heater Size	5-4-5A	5-2-5A	6-2-5B	6-2-6A	7-2-6B	8-2-6B	9-2-8A	10-2-8B	12-2-10A	13-2-10B	13-2-10B	14-2-12B	15-2-12B	16-2-14A	17-2-14A	18-2-16A	18½-2-18A
Flange Size "A"	9¼"	9¼"	9¼"	10¼"	10¼"	10¼"	13¼"	13¼"	16¼"	16¼"	16¼"	16¼"	16¼"	19¼"	19¼"	22¼"	23¼"
Shell Size "B"	5½"	5½"	5½"	6⅝"	6⅝"	6⅝"	8⅝"	8⅝"	10¾"	10¾"	10¾"	12¾"	12¾"	14"	14"	16"	18"
Overall Length "C"	3'-8"	5'-8"	6'-1"	4'-6"	4'-4"	5'-2"	4'-3"	4'-5"	4'-1"	6'-6"	6'-6"	5'-4"	6'-4"	6'-9"	8'-2"	7'-9"	7'-3"
Pressure Drop (Lbs./□")	1.74	0.95	1.08	0.81	0.70	1.37	0.69	1.12	0.69	0.90	1.34	0.67	1.00	0.85	1.44	1.43	1.37
Heater Size	6-4-5A	6-4-6A	7-4-6A	7-2-6A	8-2-6B	9-2-6B	10-2-8A	11-2-8B	13-2-10A	14-2-12A	14-2-12A	15-2-12B	16-2-12B	17-2-14A	18-4-20A	18½-2-16A	19-2-18A
Flange Size "A"	9¼"	10¼"	10¼"	10¼"	10¼"	10¼"	13¼"	13¼"	16¼"	16¼"	16¼"	16¼"	16¼"	19¼"	25¼"	22¼"	23¼"
Shell Size "B"	5½"	6⅝"	6⅝"	6⅝"	6⅝"	6⅝"	8⅝"	8⅝"	10¾"	12¾"	12¾"	12¾"	12¾"	14"	20"	16"	18"
Overall Length "C"	4'-8"	3'-11"	4'-10"	5'-6"	5'-2"	6'-8"	5'-2"	5'-5"	5'-4"	5'-1"	5'-1"	6'-4"	8'-3"	8'-2"	5'-4"	8'-11"	8'-1"
Pressure Drop (Lbs./□")	2.02	1.55	2.85	0.87	0.77	1.49	0.75	1.22	0.76	0.64	0.91	0.75	1.12	0.94	2.06	1.57	1.48
Heater Size	7-4-5A	7-4-6A	8-4-6A	8-4-8A	9-2-6B	10-4-8B	11-2-8A	12-2-8B	14-2-10A	15-2-12A	15-2-12A	16-2-12B	17-4-18A	18-4-20A	18½-4-20A	19-4-24A	19½-2-18A
Flange Size "A"	9¼"	10¼"	10¼"	13¼"	10¼"	13¼"	13¼"	13¼"	16¼"	16¼"	16¼"	16¼"	23¼"	25¼"	25¼"	29¼"	23¼"
Shell Size "B"	5½"	6⅝"	6⅝"	8⅝"	6⅝"	8⅝"	8⅝"	8⅝"	10¾"	12¾"	12¾"	12¾"	18"	20"	20"	24"	18"
Overall Length "C"	5'-9"	4'-10"	5'-9"	3'-6"	6'-8"	4'-10"	6'-4"	6'-5"	6'-6"	6'-3"	6'-3"	8'-3"	5'-7"	5'-4"	6'-2"	5'-6"	9'-0"
Pressure Drop (Lbs./□")	2.3	1.84	3.30	1.28	0.84	2.82	0.81	1.32	0.83	0.76	1.09	0.82	1.64	1.32	2.27	2.20	1.59
Heater Size		8-4-6A	9-4-6A	9-4-8A	10-4-8B	11-4-8B	12-4-10A	13-4-12A	15-2-10A	16-2-12A	16-2-12A	17-4-16A	18-4-18A	18½-4-20A	19-4-20A	19½-4-24A	20-4-27A
Flange Size "A"		10¼"	10¼"	13¼"	13¼"	13¼"	16¼"	16¼"	16¼"	16¼"	16¼"	22¼"	23¼"	25¼"	25¼"	29¼"	31¼"
Shell Size "B"		6⅝"	6⅝"	8⅝"	8⅝"	8⅝"	10¾"	12¾"	10¾"	12¾"	12¾"	16"	18"	20"	20"	24"	26¾"
Overall Length "C"		5'-9"	7'-6"	4'-6"	4'-10"	6'-0"	5'-0"	4'-7"	7'-8"	8'-1"	8'-1"	7'-5"	6'-8"	6'-2"	6'-11"	6'-1"	5'-3"
Pressure Drop (Lbs./□")		2.23	3.75	1.51	1.75	3.22	2.22	2.04	0.90	0.88	1.26	3.02	1.84	1.46	2.48	2.36	1.64
Heater Size		9-4-6A		10-4-8A	11-4-8B	12-4-8B	13-4-10A	14-4-12A	16-4-14A	17-4-16A	17-4-16A	18-4-16A	18½-4-18A	19-4-20A	19½-4-20A	20-4-24A	21-4-27A
Flange Size "A"		10¼"		13¼"	13¼"	13¼"	16¼"	16¼"	19¼"	22¼"	22¼"	22¼"	23¼"	25¼"	25¼"	29¼"	31¼"
Shell Size "B"		6⅝"		8⅝"	8⅝"	8⅝"	10¾"	12¾"	14"	16"	16"	16"	18"	20"	20"	24"	26¾"
Overall Length "C"		7'-6"		5'-6"	6'-0"	7'-1"	6'-6"	5'-7"	6'-11"	7'-5"	7'-5"	8'-10"	7'-7"	6'-11"	7'-8"	6'-8"	6'-3"
Pressure Drop (Lbs./□")		2.52		1.75	2.00	3.62	2.56	2.32	2.85	1.58	2.30	3.41	2.05	1.60	2.69	2.52	2.02
Heater Size				11-4-8A	12-4-8B			15-4-12A		18-4-16A	18-4-16A	18½-4-16A	19-4-18A	19½-4-20A	20-4-20A	20½-4-24A	21½-4-27A
Flange Size "A"				13¼"	13¼"			16¼"		22¼"	22¼"	22¼"	23¼"	25¼"	25¼"	29¼"	31¼"
Shell Size "B"				8⅝"	8⅝"			12¾"		16"	16"	16"	18"	20"	20"	24"	26¾"
Overall Length "C"				6'-9"	7'-1"			6'-7"		8'-10"	8'-10"	10'-2"	8'-6"	7'-8"	8'-5"	7'-4"	6'-9"
Pressure Drop (Lbs./□")				1.98	2.25			2.60		1.82	2.62	3.82	2.25	1.74	2.90	2.68	2.21
Heater Size													19½-4-18A	20-4-20A	20½-4-20A	21-4-24A	22-4-27A
Flange Size "A"													23¼"	25¼"	25¼"	29¼"	31¼"
Shell Size "B"													18"	20"	20"	24"	26¾"
Overall Length "C"													9'-6"	8'-5"	9'-4"	8'-0"	7'-3"
Pressure Drop (Lbs./□")													2.45	1.88	3.11	2.84	2.40
Heater Size														20½-4-20A	21-4-20A	21½-4-24A	22½-4-27A
Flange Size "A"														25¼"	25¼"	29¼"	31¼"
Shell Size "B"														20"	20"	24"	26¾"
Overall Length "C"														9'-4"	10'-3"	8'-9"	8'-4"
Pressure Drop (Lbs./□")														2.02	3.32	3.00	2.58
Heater Size																22-4-24A	23-4-27A
Flange Size "A"																29¼"	31¼"
Shell Size "B"																24"	26¾"
Overall Length "C"																9'-5"	9'-4"
Pressure Drop (Lbs./□")																3.16	2.77

Class "D" Pumps

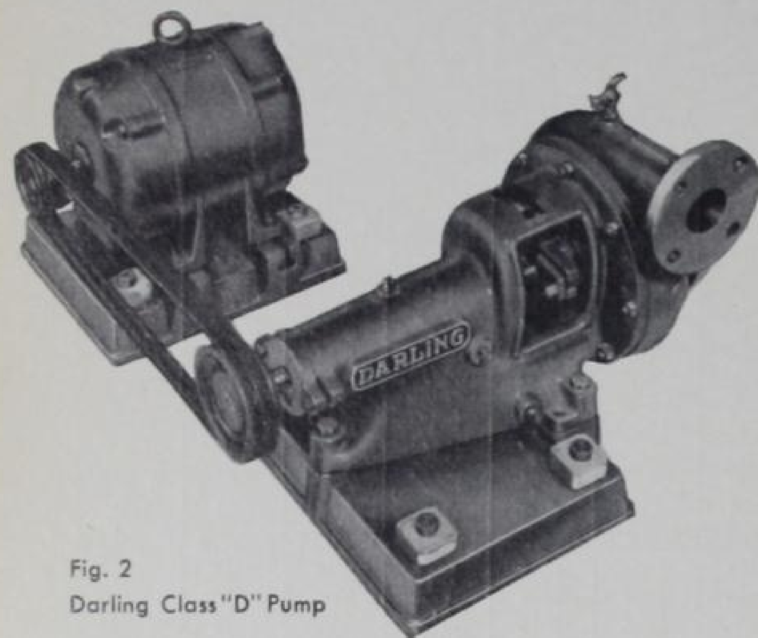


Fig. 2
Darling Class "D" Pump

DARLING CENTRIFUGAL CIRCULATING PUMPS

Fig. 2 illustrates the well known Darling Class "D" Centrifugal Circulating Pump with 'V' belt drive and separate extra heavy cast iron bases into which are fitted Darling Vibration Dampers.

Experience has shown that in locations where the noise level must be kept to a minimum, as in hospitals, institutions and apartment houses, the 'V' belt driven unit is the most satisfactory solution to the problem. Only in this way can operational noise be isolated from the heating system piping. With this method, standard pumps and motors can be used, thus reducing initial costs and simplifying maintenance routine.

The Darling Class "B" Pump of horizontal split case design is also widely used on larger heating systems. For data on this type of pump refer to Bulletin No. 41-C.

On both Class "D" and "B" Pumps, our standard 'V' belt drive will operate the pump at 1150 R.P.M. when using a 1750 R.P.M. motor. It is, therefore, important when sizing a 'V' belt driven pump to choose capacities and heads at the 1150 R.P.M. speed.

Dimensions and typical specification for the Class "D" Pump may be obtained from Bulletin No. 46-D. Darling Ready-Templates in ⅛", ¼" and ½" scale are available on request for Class "D" and "B" Pumps, in both direct connected and 'V' belt drive types.

Table 3—Capacity Table

Key: First Figure—size discharge; Last Figure—H.P. of motor.

U.S. Gallons Per Minute	Speed R.P.M.	HEAD IN FEET 10	15	20	25	30	35	40
10	1150	¾ DAWC ⅙	¾ DAWC ⅙	¾ DAAC ⅙	¾ DAAC ⅙	¾ DAAC ⅙	¾ DACC ⅓	¾ DACC ¾
	1450	¾ DAWC ¼	¾ DAWC ⅙	¾ DAAC ⅙	¾ DAAC ⅙	¾ DAAC ⅙	¾ DAAC ⅙	¾ DAAC ⅙
	1750		¾ DAWC ⅙	¾ DAWC ⅙	¾ DAWC ⅙	¾ DAWC ¼	¾ DAWC ⅓	¾ DAAC ⅙
15	1150	1 DAWC ¼	1¼ DAWC ⅙	1 DAAC ⅙	1 DAAC ⅙	1 DAAC ¼	1 DACC ½	1 DACC ½
	1450	1 DAWC ¼	1 DAWC ⅙	1 DAWC ⅙	1 DAAC ⅙	1 DAAC ¼	1 DAAC ¼	¾ DAAC ¾
	1750			1 DAWC ¼	1 DAWC ¼	1 DAWC ¼	1 DAWC ⅓	¾ DAAC ¾
20	1150	1¼ DAWC ¼	1¼ DAWC ⅙	1 DAAC ⅙	1¼ DAAC ⅓	1¼ DAAC ⅙	1 DACC ¾	1 DACC 1
	1450	1¼ DAWC ¼	1¼ DAWC ⅓	1¼ DAWC ¼	1 DAAC ⅙	1 DAAC ¼	1 DAAC ⅓	1 DAAC ¾
	1750			1 DAWC ⅙	1 DAWC ⅙	1 DAWC ⅓	1 DAWC ⅓	1 DAAC ⅓
25	1150	1¼ DAWC ¼	1¼ DAWC ⅙	1¼ DAAC ¼	1¼ DAAC ⅓	1¼ DAAC ⅓	1¼ DACC ¾	1¼ DACC 1
	1450	1¼ DAWC ⅙	1¼ DAWC ⅙	1¼ DAWC ¼	1 DAAC ⅙	1 DAAC ⅓	1 DAAC ¾	1¼ DAAC ¾
	1750		1¼ DAWC ¼	1¼ DAWC ¼	1¼ DAWC ⅓	1¼ DAWC ¼	1¼ DAWC ⅓	1 DAAC ¾
30	1150	1¼ DAWC ¼	1¼ DAWC ¼	1¼ DAAC ⅓	1¼ DAAC ⅓	1¼ DAAC ½	1¼ DACC 1	1¼ DACC 1
	1450	1¼ DAWC ⅓	1¼ DAWC ¼	1¼ DAWC ¼	1¼ DAAC ¼	1¼ DAAC ¼	1¼ DAAC ¾	1¼ DAAC ¾
	1750		1¼ DAWC ⅓	1¼ DAWC ⅓	1¼ DAWC ⅓	1¼ DAWC ⅓	1¼ DAAC ¾	1¼ DAAC 1
35	1150	1¼ DAWC ¼	1¼ DAWC ⅓	1¼ DAAC ⅓	1¼ DAAC ½	1¼ DAAC ½	1¼ DACC 1	1¼ DACC 1
	1450	1¼ DAWC ⅓	1¼ DAWC ⅓	1¼ DAWC ⅓	1¼ DAAC ½	1¼ DAAC ½	1¼ DAAC ½	1¼ DAAC ¾
	1750	1¼ DAWC ¼	1¼ DAWC ⅓	1¼ DAWC ⅓	1¼ DAWC ½	1¼ DAWC ½	1¼ DAAC ¾	1¼ DAAC 1
40	1150	2 DAWC ⅓	2 DAWC ¼	1¼ DAAC ⅓	1¼ DAAC ½	1¼ DAAC ½	1¼ DACC 1	1¼ DACC 1½
	1450	1¼ DAWC ⅓	1¼ DAWC ¼	1¼ DAWC ⅓	1¼ DAAC ½	1¼ DAAC ¾	1¼ DAAC ¾	1¼ DAAC 1
	1750		1¼ DAWC ⅓	1¼ DAWC ⅓	1¼ DAWC ½	1¼ DAWC ¾	1¼ DAAC ¾	1½ DAAC 1
50	1150	2 DAWC ⅓	2 DAWC ⅓	1¼ DAAC ⅓	1¼ DAAC ½	1¼ DAAC 1	1¼ DACC 1	1¼ DACC 1½
	1450		2 DAWC ⅓	2 DAWC ½	1¼ DAAC ½	1¼ DAAC ¾	1¼ DAAC 1	1¼ DAAC 1
	1750		1¼ DAWC ⅓	1¼ DAWC ½	1¼ DAAC ½	1¼ DAAC ¾	1¼ DAAC ¾	1¼ DAAC 1
60	1150	2 DAWC ⅓	2 DAWC ½	1¼ DAAC ½	1¼ DAAC ½	1¼ DAAC 1	1¼ DACC 1	1¼ DACC 1½
	1450	1¼ DAWC ⅓	2 DAWC ⅓	2 DAWC ½	1¼ DAAC ½	1¼ DAAC ¾	1¼ DAAC 1	1¼ DAAC 1½
	1750	1¼ DAWC ⅓	1¼ DAWC ½	1¼ DAWC ½	1¼ DAAC ½	1¼ DAAC ¾	1¼ DAAC 1	1¼ DAAC 1
75	1150	2 DAWC ⅓	2 DAWC ½	1¼ DAAC ½	1¼ DAAC 1	1¼ DACC 1½	1¼ DACC 1½	1¼ DAYC 1½
	1450	2 DAWC ⅓	2 DAWC ½	2 DAWC ½	1¼ DAAC 1	1¼ DAAC 1	1¼ DAAC 1½	1¼ DAAC 1½
	1750	1¼ DAWC ½	2 DAWC ½	2 DAWC ½	1¼ DAAC 1	1¼ DAAC 1	1¼ DAAC 1½	1¼ DAAC 1½
100	1150	2 DAWC ½	2 DAAC 1	2 DAAC 1	2 DAAC 1½	2 DAAC 1½	2 DXCC 2	2 DXCC 2
	1450	2 DAWC ½	2 DAWC ¾	2 DAWC 1	2 DAAC 1½	2 DAAC 1½	2 DAAC 2	2 DAAC 2
	1750	2 DAWC ½	2 DAWC ¾	2 DAWC 1	2 DAAC 1	2 DAAC 1½	2 DAAC 2	2 DAAC 2
125	1150	2 DAAC 1	2 DAAC 1	2 DAAC 1	2 DAAC 1½	2 DAAC 1½	2 DXCC 2	2 DXCC 2
	1450	2 DAWC ¾	2 DAWC 1	2 DAAC 1	2 DAAC 1½	2 DAAC 1½	2 DAAC 2	2 DAAC 2
	1750	2 DAWC ¾	2 DAWC 1	2 DAWC 1	2 DAAC 1½	2 DAAC 1½	2 DAAC 2	2 DAAC 2
150	1150	3 DAAC 1	3 DAAC 1	3 DAAC 1½	3 DAAC 2	3 DAAC 2	2 DXYC 3	2 DXYC 3
	1450	3 DAAC ¾	3 DAAC 1	2 DAAC 1½	2 DAAC 2	2 DAAC 2	2 DAAC 3	2 DAAC 3
	1750	3 DAAC ¾	3 DAAC 1	2 DAAC 1½	2 DAAC 2	2 DAAC 2	2 DAAC 2	2 DAAC 3
175	1150	3 DAAC 1	3 DAAC 1½	3 DAAC 1½	3 DAAC 2	3 DAAC 2	2 DXYC 3	2 DXYC 3
	1450	3 DAAC 1	3 DAAC 1½	3 DAAC 1½	3 DAAC 2	3 DAAC 2	2 DAAC 3	2 DAAC 3
	1750	3 DAAC 1	3 DAAC 1½	3 DAAC 1½	3 DAAC 1½	3 DAAC 2	2 DAAC 3	2 DAAC 3
200	1150	3 DAAC 1	3 DAAC 1½	3 DAAC 2	3 DAAC 2	3 DXCC 3	3 DXCC 3	3 DXCC 3
	1450	3 DAAC 1	3 DAAC 1½	3 DAAC 1½	3 DAAC 2	3 DAAC 2	3 DAAC 3	3 DAAC 3
	1750	3 DAAC 1	3 DAAC 1½	3 DAAC 1½	3 DAAC 2	3 DAAC 2	3 DAAC 3	3 DAAC 3
225	1150	3 DAAC 1½	3 DAAC 1½	3 DAAC 2	3 DAAC 2	3 DXCC 3	3 DXCC 3	3 DXCC 3
	1450	3 DAAC 1½	3 DAAC 1½	3 DAAC 2	3 DAAC 3	3 DAAC 3	3 DAAC 3	3 DAAC 3
	1750	3 DAAC 1½	3 DAAC 1½	3 DAAC 2	3 DAAC 2	3 DAAC 3	3 DAAC 3	3 DAAC 3
250	1150	3 DAAC 1½	3 DAAC 2	3 DAAC 2	3 DAAC 3	3 DXCC 3	3 DXCC 5	3 DXCC 5
	1450	3 DAAC 1½	3 DAAC 2	3 DAAC 2	3 DAAC 3	3 DAAC 3	3 DAAC 3	3 DAAC 5
	1750	3 DAAC 1½	3 DAAC 2	3 DAAC 2	3 DAAC 3	3 DAAC 3	3 DAAC 3	3 DAAC 5
300	1150	4 DXAC 1½	4 DXAC 2	4 DXAC 3	4 DXAC 3	4 DXAC 3	4 DXYC 5	4 DXYC 5
	1450	3 DAAC 2	3 DAAC 3	3 DAAC 3	3 DAAC 3	3 DAAC 5	3 DAAC 5	3 DAAC 5
	1750	3 DAAC 2	3 DAAC 3	3 DAAC 3	3 DAAC 3	3 DAAC 5	3 DAAC 5	3 DAAC 5
350	1150	4 DXAC 2	4 DXAC 3	4 DXAC 3	4 DXAC 3	4 DXAC 5	4 DXYC 5	4 DXYC 5
	1450	3 DAAC 2	3 DAAC 3	3 DAAC 3	3 DAAC 5	3 DAAC 5	3 DAAC 5	3 DXCC 5
	1750	4 DAAC 3	4 DAAC 3	4 DAAC 3	3 DAAC 5	3 DAAC 5	3 DAAC 5	3 DAAC 5
400	1150	4 DXAC 2	4 DXAC 3	4 DXAC 3	4 DXAC 5	4 DXYC 5	4 DXYC 5	4 DXYC 5
	1450		4 DXAC 3	4 DXAC 3	4 DXAC 5	4 DXAC 5	4 DXAC 5	4 DXAC 7½
	1750			4 DXAC 3	3 DAAC 5	3 DAAC 5	3 DAAC 5	3 DAAC 7½
450	1150	4 DXAC 3	4 DXAC 3	4 DXAC 5	4 DXAC 5	4 DXYC 5	4 DXYC 5	4 DXYC 7½
	1450	4 DXAC 3	4 DXAC 3	4 DXAC 5	4 DXAC 5	4 DXAC 5	4 DXAC 5	4 DXAC 7½
	1750			4 DXAC 5	4 DXAC 5	4 DXAC 5	4 DXAC 5	4 DXAC 7½
500	1150	4 DXAC 3	4 DXAC 3	4 DXAC 5	4 DXYC 5	4 DXYC 5	4 DXYC 7½	4 DXYC 7½
	1450	4 DXAC 3	4 DXAC 5	4 DXAC 5	4 DXAC 5	4 DXAC 5	4 DXAC 7½	4 DXAC 7½
	1750			4 DXAC 5	4 DXAC 5	4 DXAC 5	4 DXAC 7½	4 DXAC 7½

Sylphon Temp. Regulators

Table 4

TEMPERATURE RANGES

Temperature ranges below are for No. 931 regulator. See description of No. 931-OR for its ranges. Order by range number.

40° Ranges No.	40° Ranges Range	60°, 80° and 120° Ranges No.	60°, 80° and 120° Ranges Range
46-H	40°— 80° F.	46-K	40°—100° F.
50-H	60°—100° F.	50-K	60°—120° F.
56-H	90°—130° F.	56-K	90°—150° F.
58-H	100°—140° F.	58-K	100°—160° F.
62-H	120°—160° F.	62-K	120°—180° F.
66-H	140°—180° F.	66-K	140°—200° F.
70-H	160°—200° F.	70-K	160°—220° F.
74-H	180°—220° F.	74-K	180°—240° F.
76-H	190°—230° F.	76-K	190°—250° F.
80-H	210°—250° F.	80-K	210°—270° F.
82-H	220°—260° F.	82-K	220°—280° F.
84-H	230°—270° F.	84-K	230°—290° F.
87-H	245°—285° F.	87-K	245°—305° F.
93-H	275°—315° F.	93-K	275°—335° F.
96-H	290°—330° F.	96-K	290°—350° F.
		110-K	360°—420° F.
		110-P	360°—440° F.
		*110-WD	360°—480° F.

*Range 110-WD is not available for regulator sizes 2″ and larger.

DIMENSIONS

Valve Size, Inches	½	¾	1	1¼	1½	2	2½	3	4	5
*Pressure Limit, Pounds	250	250	250	250	225	85	65	55	40	30
Shipping Weight, Pounds	49	50	53	64	68	108	129	170	200	250
A	16 3/16	16 3/16	16 3/16	16 3/16	17¼	18 1/16	18 9/16	20⅜	21 1/16	25 9/16
B	14 3/16	14 3/16	14 3/16	14 3/16	14 3/16	14 3/16	14 3/16	15½	15½	15½
D	2	2	2⅝	2⅝	3 1/16					
E	5½	5¾	7	7⅝	8½					
K	7⅜	7⅜	7⅜	7⅜	7⅜	7⅜	7⅜	7⅜	7⅜	7⅜
L	2	2	2⅝	2⅝	3 1/16					
M						3⅞	4⅜	4⅞	5 13/16	10 1/16
N						7	7¼	8¾	10¼	15⅞
O						3 1/16	3 9/16	3 13/16	4½	9 1/16

*Pressure drop across valve.

Standard bulb for temperature ranges beginning at 100°F. or above.

G	1	1	1	1	1	1	1	1	1	1¼
H	9	9	9	9	9	13	13	17	17	16
T	1–11½	1–11½	1–11½	1–11½	1–11½	1–11½	1–11½	1–11½	1–11½	1¼ 11½

Standard bulb for temperature ranges beginning below 100°F. Under certain conditions, smaller bulbs may be used. Information on request.

G	1¼	1¼	1¼	1¼	1¼	11¼	1¼	1¼	1¼	1¼
H	24	24	24	24	24	24	24	24	24	30
T	1¼–11½	1¼–11½	1¼–11½	1¼–11½	1¼–11½	1¼–11½	1¼–11½	1¼–11½	1¼–11½	1¼–11½

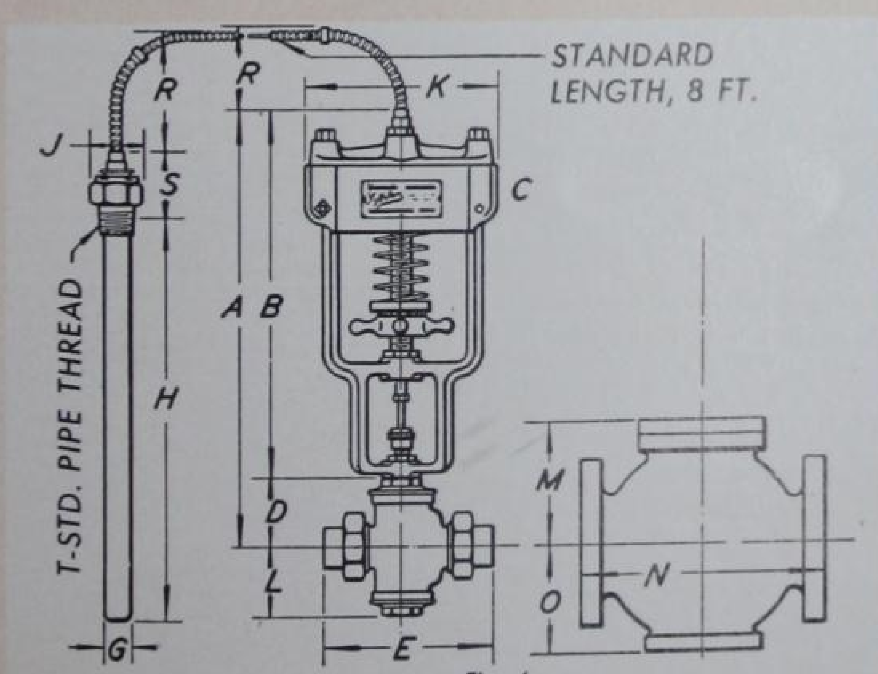


Fig. 4

No. 931 REGULATOR

The No. 931 temperature regulator is largely used in industrial processes where one definite temperature is required from day to day. It is also widely used to control temperature of hot water storage tanks and convertors.

The No. 12B bulb is standard and is dimensioned in table at left. It is made of copper and its fittings are of brass. Brass armor covers the flexible copper tubing between the bulb and regulator proper. This armored tubing is regularly furnished 8 feet long. Longer lengths available. Bulb and its fittings, as well as flexible tubing and its armor, can be furnished made of other metals.

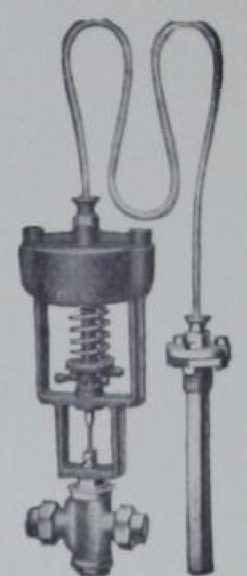


Fig. 3

This regulator is made in valve sizes ½″ to 5″ inclusive. Sizes ½″ to 4″ inclusive, are equipped with type "F" direct-acting valve. 5″ size is equipped with type "E" direct-acting valve. Bronze trim supplied unless otherwise ordered. A reverse-acting valve will be furnished on order. Sizes ½″ to 1½″, inclusive, have screwed ends. Sizes 2″ and above, flanged ends (125 lbs. A.S.A. Ratings.)

PRESSURE LIMITS

The standard No. 931 regulator is not suitable where the pressure drop across valve exceeds the limits given in table at left. *A stainless steel trimmed valve should be used for pressures above 50 lbs., or for superheated steam.*

INSTALLATION

Bulb is to be inserted in the vessel so it will contact the liquid under control. A strainer should be installed ahead of the regulating valve.

TEMPERATURE ADJUSTMENT

This regulator can be set to control at any point within its temperature range by merely turning the adjustment wheel located just below the regulator head.

No. 931-OR REGULATOR

If it is necessary for the regulator to withstand, without damage, temperatures at the bulb of more than 20° above top end of the adjustable range, then the "Over-Run" feature must be supplied. This feature will protect against temperatures up to 100° above top of the range; and, in some cases, higher temperatures.

The "Over-Run" feature is not normally required for refrigerating ranges since the bulb temperature is normally lower than the (bellows) temperature at head of regulator.

When supplied with "Over-Run" feature, the regulator is designated as No. 931-OR. Valve sizes, pressure limits and temperature ranges same as for No. 931 except No. 931-OR in sizes 3″ and above is not available with 60° temperature ranges; and, in any size with 80° or 120° ranges.

Webster Float and Thermostatic Drip Traps

Working Pressure To 15 Lbs. per Sq. In.

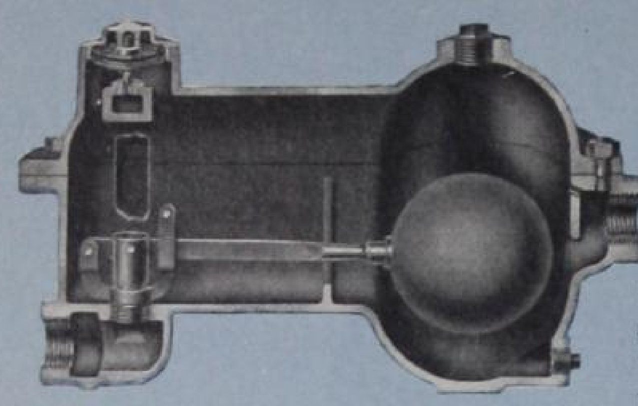


Fig. 5 Webster Heavy Duty Drip Trap, Size 126-T. The 226-T is similar.

SERIES 26-T: Heavy duty traps, capable of handling large volumes of condens tion and air. Compact and light in weight. Suited for drips of mains, air conditio ing coils, blast radiation, unit heaters, hot water convertors, fan heater coils, ar similar applications. Side outlet opening. The most used sizes (00026, 0026, 02 incorporate the *outward opening* discharge valve—which permits the valve open when excessive pressures prevail, and thus prevents waterlogged piping or equipment.

Construction Features: Brass valve pieces and seats on water discharge end. Thermostatic air vent diaphragms are Monel Metal with valve pieces and seats of brass. Other interior parts are copper, brass or iron. Cast iron bodies and covers. Size 00026 has one inlet opening and one outlet on cover plate. A choice of two inlet openings in opposite sides of body and two outlet openings at bottom is provided in sizes 0026 and 026. Pipe plugs included for one inlet and outlet. These sizes can be mounted in pipe line without other support. Sizes 126 and 226 have single end inlets and outlets and require a supporting bracket when installed. Large ball float and long lever provide ample power for operation of inward opening valve.

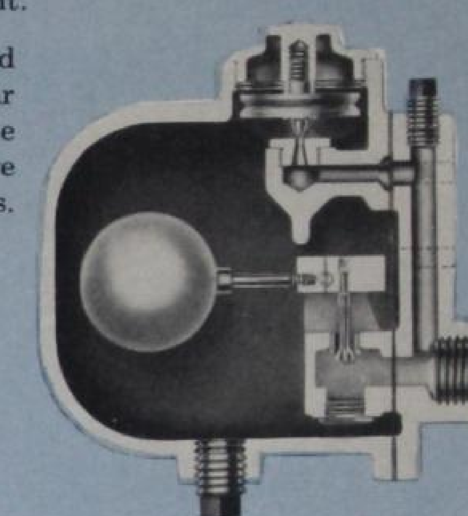


Fig. 6 Webster Heavy Duty Drip Trap, Size 00026-T.

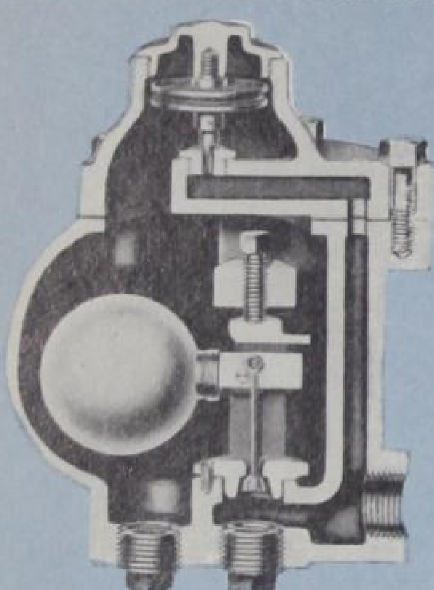


Fig. 7 Webster Heavy Duty Drip Trap, Size 0026-T. The 026-T is similar excepting that float interior is bolted instead of clamped.

SERIES 26-O: Similar to the 26-T but with plain cover instead of cover incorporating thermostatic element and by-pass. Used where concentration of air does not occur, such as on ends of mains and risers, on flash tanks and for dripping gravity heating systems into vacuum return lines. Provision is made for external air by-pass.

Table 5. Recommended Ratings of Webster Series 26 Float and Thermostatic Traps in Lbs. Water per Hour

Size Inches	Symbol	Pressure Difference Across Trap in Lbs. per Sq. In.								
		1/8	1/4	1/2	3/4	1	2	5	10	15
3/4	00026-T and O	50	70	100	120	140	200	210	220	23
1	0026-T and O	125	175	250	300	350	500	525	550	57
1 1/4	026-T and O	300	425	600	735	850	1200	1260	1320	138
1 1/2	126-T and O	600	850	1200	1470	1700	2400	2520	2640	276
2	226-T and O	1250	1775	2500	3060	3550	5000	5250	5500	575

Conversion Factors: To convert ratings given in lbs. per hour of water to sq. ft. e.d.r at 240 B.t.u., multiply by 4. Ratings are in accordance with standards adopted by th Steam Heating Equipment Manufacturers Association, providing for the continuou elimination of air when the trap is operating at its maximum rating.

BRANCH OFFICES AND REPRESENTATIVES

HALIFAX, N.S.
E. S. Stephenson & Co., Ltd. .... 155 Granville Street

SAINT JOHN, N.B.
E. S. Stephenson & Co., Ltd. .... 15 Dock Street

QUEBEC, P.Q.
W. J. Banks .... 140 St. John Street

ARVIDA, P.Q.
René Beaudet & Cie Ltée .... 122 Davis Street

TIMMINS, ONT.
Patricia Engineering Ltd. .... 168 Third Ave.

OTTAWA, ONT.
Darling Brothers Limited .... 18 Rideau Street

TORONTO, ONT.
Darling Brothers Limited .... 137 Wellington St. W.

WINNIPEG, MAN.
Darling Brothers Limited .... 123 Princess Street

CALGARY, ALTA.
H. F. Clarke & Co. Ltd. .... 1114 Fifth St. W.

VANCOUVER, B.C.
Frank Darling & Co. Ltd. .... 1144 Homer St.

ST. JOHN'S, NFLD.
Clayton Construction Co. Ltd. .... 198 Water St.

DARLING

HEAD OFFICE AND WORKS

BROTHERS LIMITED

140 PRINCE ST. MONTREAL, CANADA

SINCE 1888

Darling

CLASS "DG" CENTRIFUGAL PUMPS

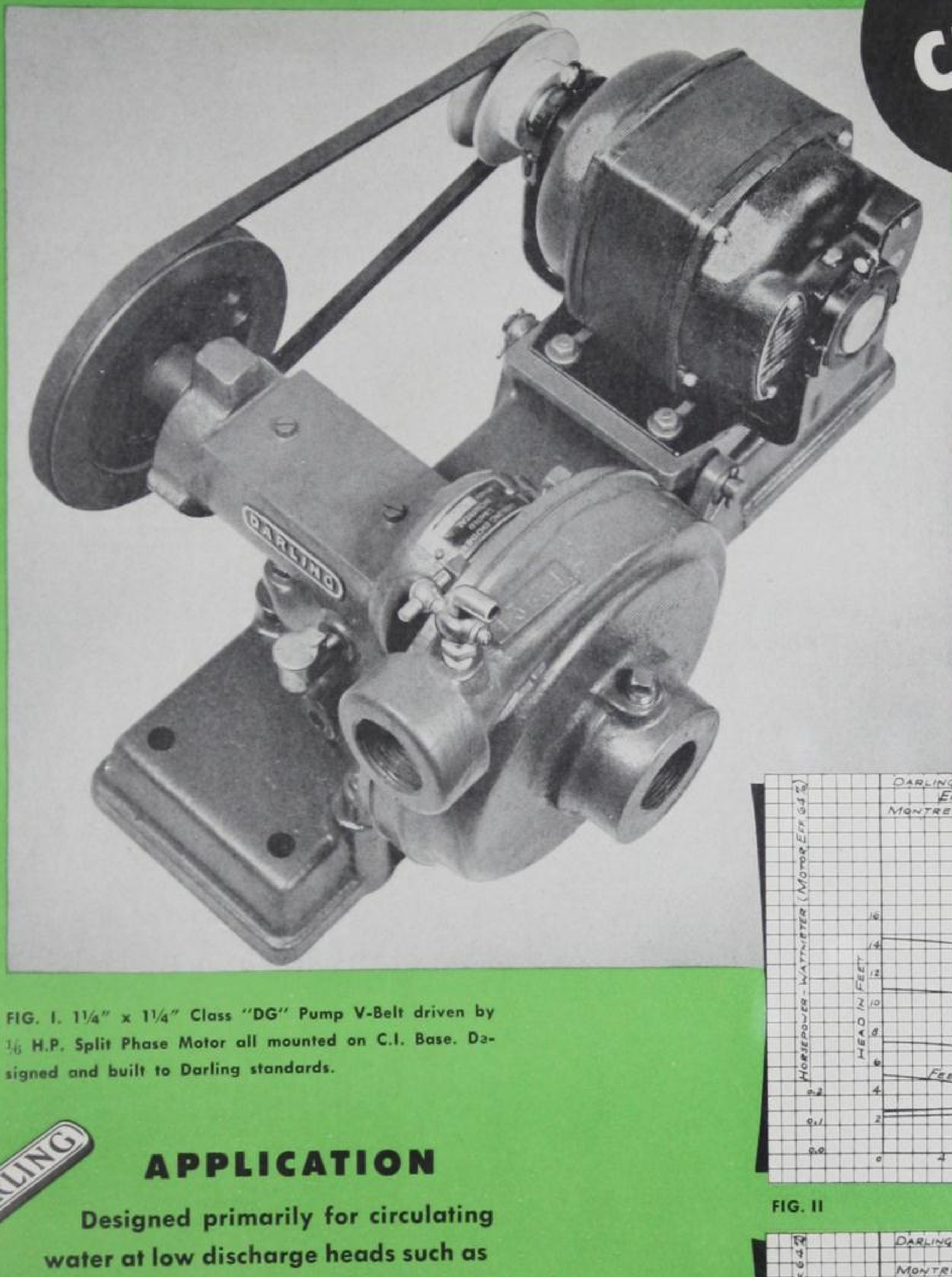


FIG. I. 1¼" x 1¼" Class "DG" Pump V-Belt driven by ⅙ H.P. Split Phase Motor all mounted on C.I. Base. Designed and built to Darling standards.

APPLICATION

Designed primarily for circulating water at low discharge heads such as required in the smaller forced hot water heating systems.

Capacities range from 2 IMP. GPM up to 25 IMP. GPM and heads from 2 ft. to 25 ft. as shown in curves at right. For quietness of operation, with a minimum of attention this unit is ideal.

CAPACITIES

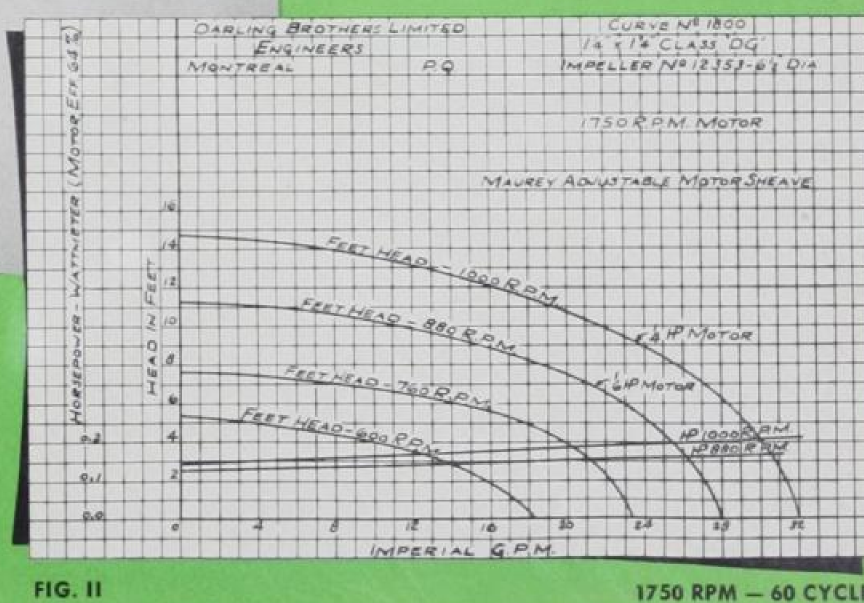


FIG. II 1750 RPM — 60 CYCLE

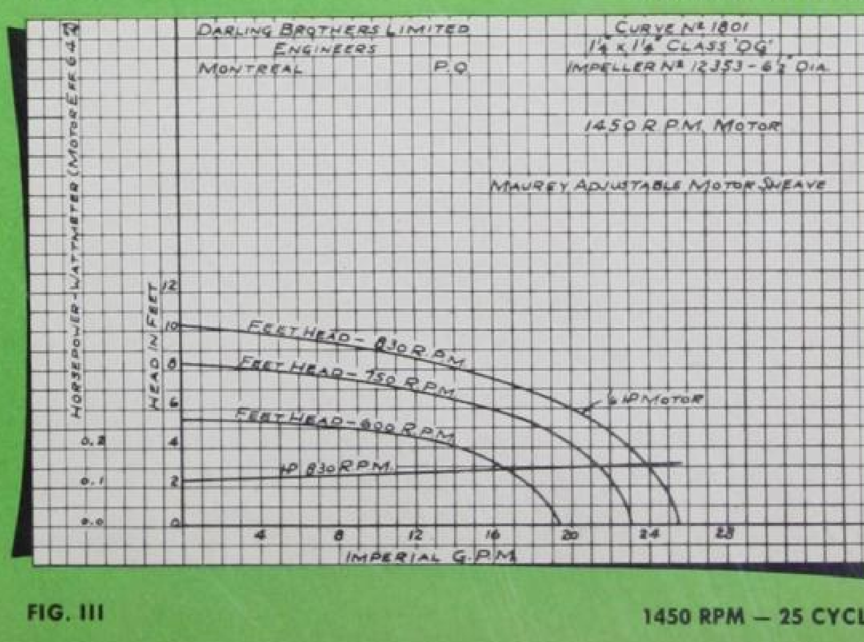
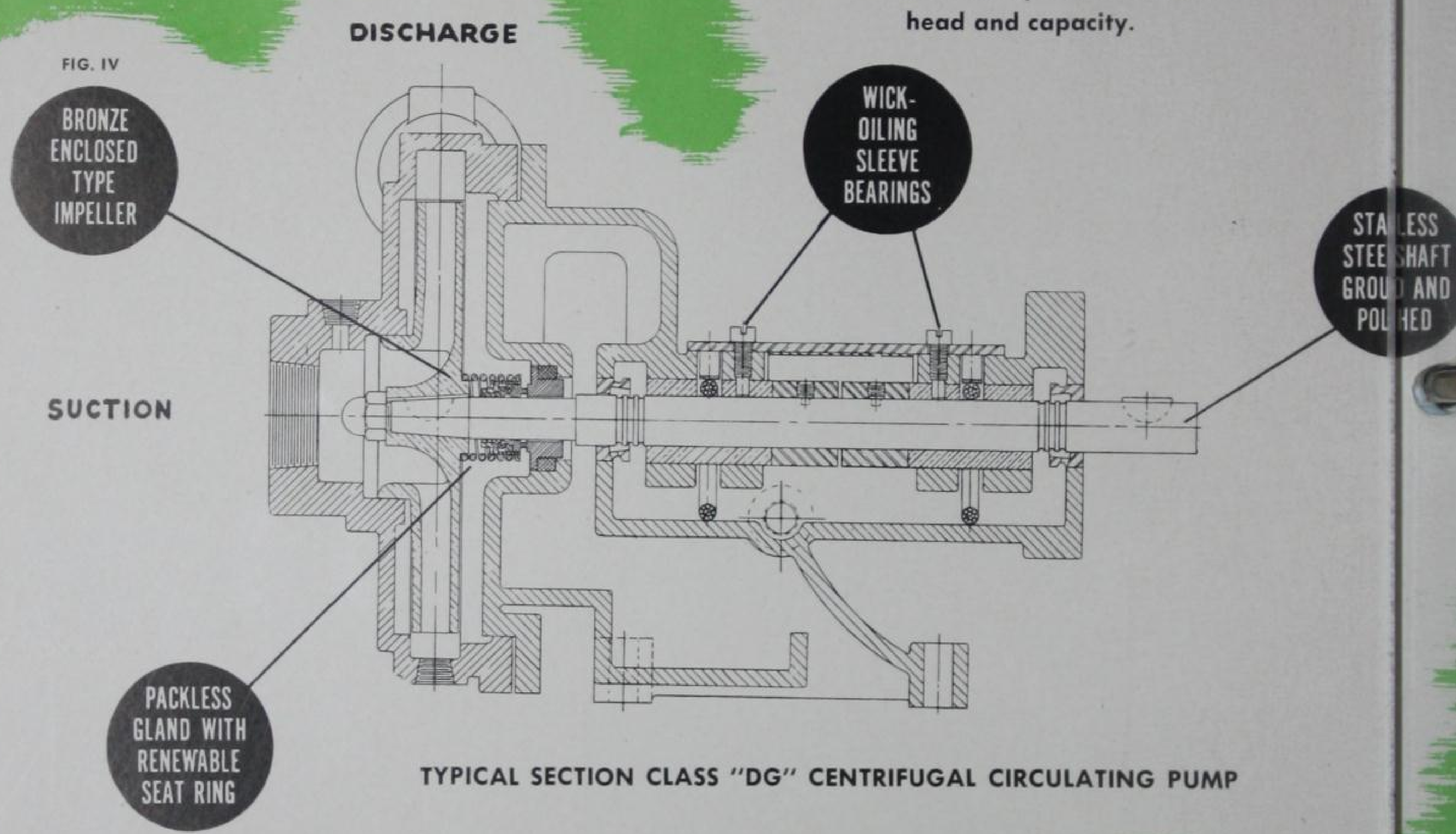


FIG. III 1450 RPM — 25 CYCLE

CONSTRUCTION FEATURES

The special features incorporated in the design of this pump ensure quietness of operation and minimum attention. Special features include sleeve bearings, packless gland and isolation of motor from system and building by V-Belt drive and rubber trunnion mounting. Adjustable speed pulley on motor permits running standard pump at different speeds to obtain desired head and capacity.

FIG. IV



TYPICAL SECTION CLASS "DG" CENTRIFUGAL CIRCULATING PUMP

ELECTRONIC
Continuous Flow

WEBSTER MODERATOR
TRADE MARK REG. U.S. PAT. OFF.

SYSTEM
OF STEAM HEATING

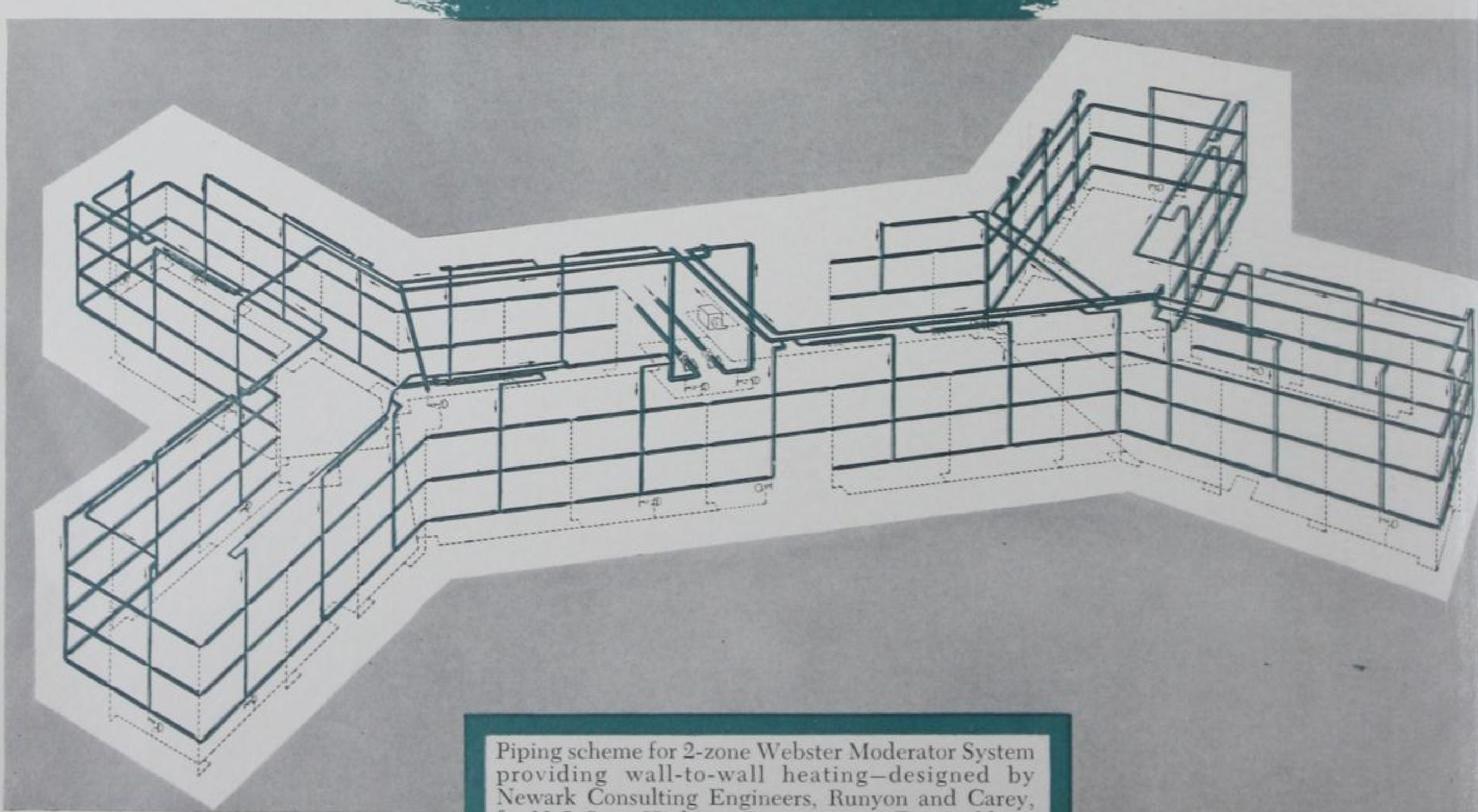
"Controlled by the weather"

Bulletin B-900-4B

WARREN WEBSTER & COMPANY
CAMDEN 5, NEW JERSEY

fuel savings

BEGIN WITH A SOUND HEATING PLAN



Piping scheme for 2-zone Webster Moderator System providing wall-to-wall heating—designed by Newark Consulting Engineers, Runyon and Carey, for N. J. State Highway Department Office Building.

IF you have a building to be heated with steam, you can heat it better (greater comfort, reduction of overheating and underheating) and at lower cost with a "Controlled-by-the-Weather" Webster Moderator System.

That's the conclusion of architects, engineers and contractors who have specified or installed the Webster Moderator System in thousands of steam heated buildings.

Building owners and managers have fuel savings records to prove the soundness of the heating plans. For example:

An office building cut steam consumption $5,671 in three years. . . . A new hospital used 18% less steam than the conservative engineering estimate. . . . A group of 14 university buildings cut heating costs $9,500 in 12 months. . . . An apartment building saved $567 in the first year.

A heating plan that includes a Webster Moderator System is simple, flexible and comfort producing . . .

—simple because there are just four control elements for each zone. The balancing of the system is done from the heating plan by the accurate sizing of Webster Metering Orifices in radiator supply valves.

—flexible because each system is "tailor made" for the building in which it is installed. Each section of the building receives the desired amount of heat. Shut off a single room or an entire floor and the system automatically compensates for the decreased demand.

—comfort producing because the Webster Outdoor Thermostat speeds up the delivery of heat when the outdoor temperature falls and slows down the delivery when the outdoor temperature rises.

PROVEN IN SERVICE

It is now more than twenty-five years since the installation of the first Webster Moderator System of Steam Heating. During this period, the fundamental features of continuous steam flow, balanced distribution by the use of metering orifices, automatic control by Outdoor Thermostat, and manual supplementary control at a central point have been continued without change.

Of course, the detailed mechanical means for accomplishing these fundamental features have been continuously refined, resulting in lower costs of the complete installation, lessened maintenance and improved operation. As a result, today the cost of the Webster Moderator System makes its application practical in much smaller buildings than was the case twenty years ago. This year . . . just as in every year since its introduction . . . has seen a wider use of this modern system than in any preceding year.

We solicit consideration of the Webster Moderator System primarily on the basis of proven performance. The Company's products and services are backed by an ample modern plant and resources, a corporate experience extending over more than half a century, and sales and service facilities in 60 United States cities and Canada.

The famous Equitable Building, a New York City Broadway landmark since 1914, has 4,800 Webster Sylphon Traps, installed in the original Webster Vacuum System of Steam Heating. In 1949, after checking with 50 leaders in the building management field in New York, the owners decided to convert their installation to a Webster Moderator System of Steam Heating, with heating "Controlled-by-the-Weather."

Original Installation Architect: Ernest R. Graham. Heating and General Contractors: Thompson-Starrett Co., Inc. Heating Modernization, Consulting Engineers: Franklin J. Leerburger and Joseph R. Weiss. Contractor: Carl E. Joecks.

Webster Moderator Steam Heating Systems for New Buildings and Modernization

Heating specifications for this 180-bed East Tennessee TB Hospital, Knoxville, Tenn., said: *"There shall be continuous flow of steam to the system with full or fractional heating of radiators at all times when heat is on."* A 4-zone Webster Moderator System of Steam Heating meets this specification, supplying steam according to need for nursing floors, service and treatment units, operating rooms and laboratories.

Architects and Engineers: Baumann and Baumann, Will W. Griffin and Shi G. Goodwyne Associates. Heating Contractors: John F. Humphrey Company, Knoxville. Medical Consultants: Dr. R. H. Hutcheson, Commissioner of Public Health and Secretary of the Tennessee TB Commission, and Dr. W. W. Hubbard, Director of Hospital Service for the State of Tennessee.

WEBSTER HEATING SYSTEMS

There is a type of Webster Heating System to meet practically every need and purpose. These include Webster Steam Heating Systems for larger buildings of almost every type, and Webster Baseboard Heating, a hot water system particularly suited for small residences and other small buildings.

WEBSTER MODERATOR STEAM HEATING SYSTEMS

Webster Moderator Steam Heating Systems are all low-pressure, two-pipe systems of steam circulation in which steam is delivered to radiators and other heating surfaces through supply piping. Water of condensation and air are removed through separate return piping. Webster Radiator Valves and Thermostatic Traps are installed respectively on the supply and discharge connection of each radiator. Webster thermostatic or float and thermostatic traps provide for prompt removal of water of condensation and air from the piping.

Webster Moderator Steam Heating Systems are available with vacuum return, or with open return (vented to the atmosphere) with either condensation pump or Webster Boiler Return Trap and Vent Trap to return water to the boiler, or with Vent Trap alone where condensate is wasted to the sewer, and in appropriate small installations.

Vacuum returns may be employed where vacuum return pump installation is desired.

These modern Webster Systems should never be confused with old-fashioned steam heating or with crude one-pipe steam systems. While utilizing steam at low pressures and thereby incorporating all of the many advantages inherent in its use, the modern Webster Moderator Systems of Steam Heating provide a combination of features which makes them particularly deserving of consideration for larger buildings of almost every type.

STEAM SUPPLY

Webster Moderator Systems take steam from any source at any pressure. In most cases they are supplied from low-pressure sources, usually low-pressure boiler plants which may burn coal, coke, oil, gas or other fuels. Or they may take steam from a central heating plant or a "city main." Where a high-pressure source exists, steam pressure is reduced to the desired pressure through one or more pressure reducing valves before being supplied to the heating system.

STEAM DISTRIBUTION

Steam at low pressure is ideal for distribution. It goes from place to place by virtue of the pressure created in its generation, and surprisingly little pressure indeed is sufficient to cause it to move from the point of supply to the point of use. No fans or pumps are necessary when heat is moved in the form of steam.

Steam distribution piping can be arranged with the utmost flexibility. Steam mains may run in a loop around the circumference of a building, or a trunk main may run directly through the center with branches taken off at right and left. The distribution mains may be located in the basement with vertical connections rising to the various floors. Or, if desired, the distribution mains may be located at the top floor with vertical connections feeding downward. In other instances, distribution mains may be located at an intermediate level, with risers feeding both upwards and downwards. There are practically no restrictions to the arrangement of distribution piping when you use a Webster Moderator System of Steam Heating.

Distribution piping is ordinarily insulated to reduce heat loss. This should be done for maximum steam economy and most effective control. However, where minimum first cost is of greatest importance, the distribution piping may be considered a part of the effective heating surface with a consequent reduction

in the size of the radiators required. The closeness of control will of course be decreased since the heat output of the risers will not be controlled.

Easy and quiet distribution, which is both quick and effective, is assured by selection of proper sizes of pipes and by proper grading. This distribution is further assured by selection of proper size and type of Webster Radiator Supply Valves and Webster Return Traps for each radiator. Webster Thermostatic or combination Float and Thermostatic Traps are used at appropriate locations in the distribution piping in order to assure that all piping will be kept automatically cleared of air and water of condensation.

RADIATORS

The great flexibility of Webster Moderator Systems of Steam Heating is again illustrated by the wide choice offered in the selection of radiators or heat transfer surfaces. Many Webster Systems employ the widely used conventional cast iron "standing" radiation, either exposed in the room or concealed behind grilles. Cast iron, steel or non-ferrous finned convectors may be used.

ORIFICES AND CONTROL

All radiators in Webster Moderator Systems get steam at the same time and substantially in proportion to the need for steam. This important result is obtained through the installation of accurately sized metering orifices in Webster Radiator Supply Valves and also, where required, by use of Intermediate Metering Orifices at suitable points in branch mains.

Each Webster Moderator System is effectively controlled to assure maximum economy and comfort. The wide flexibility of Webster Systems is further illustrated when the subject of control is considered.

Webster Moderator Systems may be used with thermostatic control of supply valves on radiators, and with the complex controls frequently used with school unit ventilators and other complete temperature control systems.

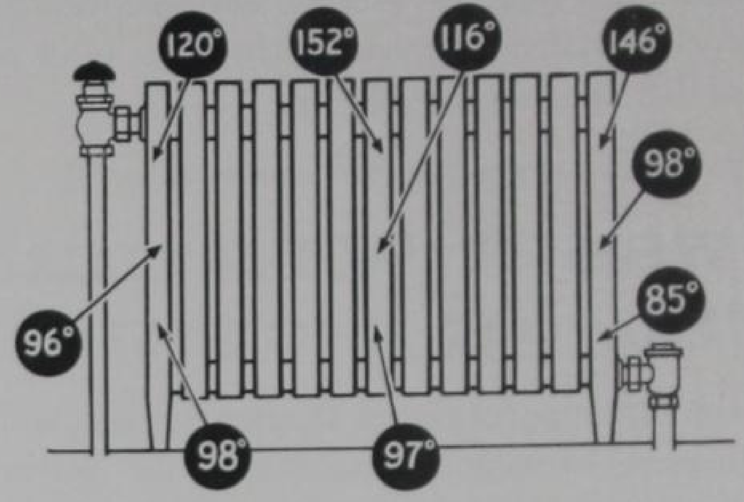


Fig. 1. Actual proof of low radiator temperatures! Here are actual temperatures at nine points and showing average radiator temperatures of 112° F. . . . due to scientifically controlled turbulence.

Webster Electronic Continuous Flow Moderator Controls work like an automobile engine throttle. They speed up or slow down the heating of the radiators and eliminate stop-and-go "traffic" in the heating system. The days when the objection could be raised that, with steam, radiators are too hot, have gone forever with modern controlled Webster Moderator Systems. Due to the combined effect of balanced steam distribution through orifices and throttling central controls, radiators in Webster Systems of Steam Heating may now have low radiator temperatures comparable with those obtained previously only with controlled hot water heating.

Webster Moderator Systems, from the simplest to the most elaborate, provide certain fundamental characteristics. Comfort, rather than exact temperature control, has been the prime objective. This has been attained by providing a system and control in which the radiators are *always pleasantly warm and never unpleasantly hot*.

Examine the illustration in Figure 1. The temperatures shown in this illustration are taken from actual

readings of a radiator in a Webster Moderator System of Steam Heating. With steam at atmospheric pressure and consequently 212° F. temperature in the supply piping radiator, temperatures nevertheless average only 112° F. This unique result is not due to " high vacuum" but to the creation of turbulence which produces a close intermixture of steam and air right in the radiator. How this turbulence is produced in cast iron radiation is shown in the illustration of Fig. 2. But it is not only with cast iron radiation that this effect is obtained.

In many installations Webster System Radiation is employed. This non-ferrous heating surface includes a substantial furniture steel cabinet which may either be exposed or concealed within the walls. Inside this cabinet is placed a single unit which incorporates a Webster Supply Valve with orifice, a copper tube and aluminum fin heat transfer surface, and a Webster Thermostatic Trap together with two solid brass union connections.

When Webster System Radiators are used, a completely prefabricated unit is provided, requiring only the piping to and from the unit. Among the advantages obtained by the use of Webster System Radiators, aside from concealment and lessened installation expense, is the delivery of a maximum amount of heat from a given amount of space occupied. Comparison of the space required for a Webster System Steam Radiator with the corresponding space required for ordinary radiators will show a substantial space saving.

With Webster System Radiators, the outlet air temperatures are always low and heating is effected in colder weather by the more rapid circulation of gently warmed air.

Where space conditions make it desirable, Webster-Nesbitt Unit Heaters may be employed in Webster Systems, or unit ventilators or fin surface. In fact, all types of heat transfer surface are operated at their best when steam is provided through a Webster Moderator System of Steam Heating.

The Electronic Webster Moderator System provides *continuous steam flow* and is in general suitable for medium to large buildings and groups of buildings requiring one or more control valves. Webster Moderator Controls are extremely flexible and, by modification and addition of supplementary equipment, can be supplied to meet almost any requirement from the large residence to the largest building groups in the world.

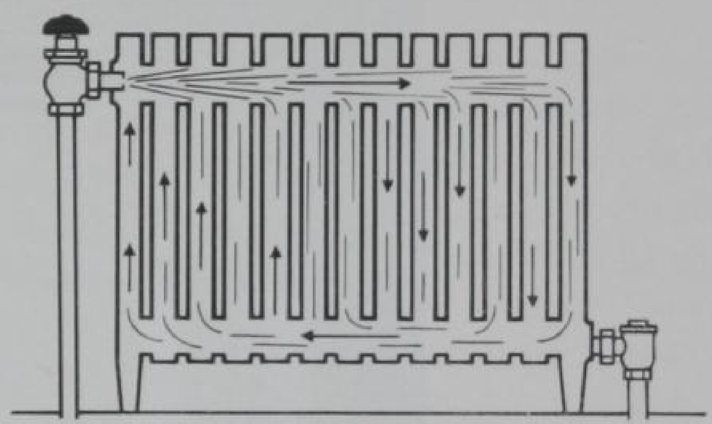
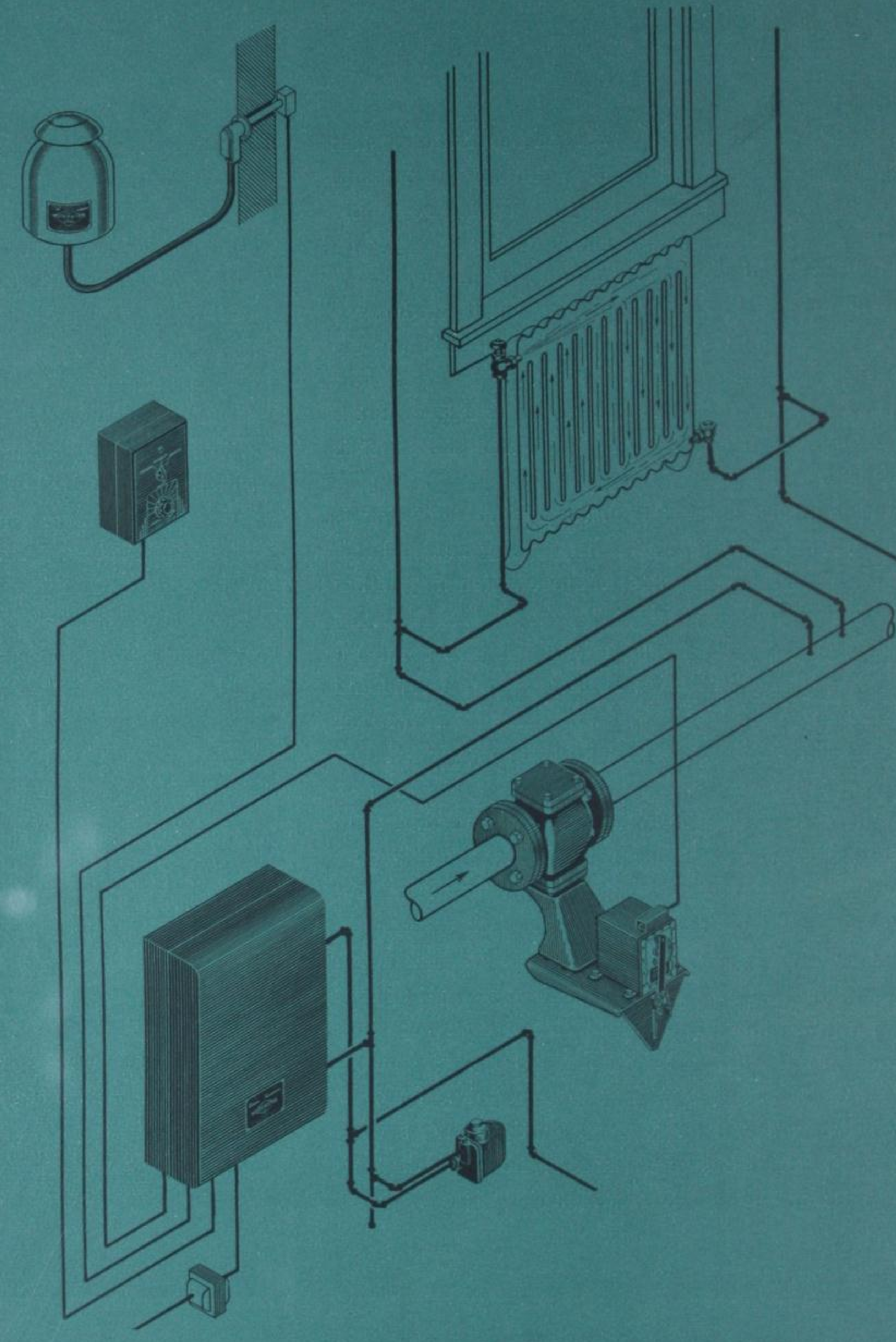


Fig. 2. Turbulence resulting from metering steam into radiators through jets at high velocity produces a close intermixture of steam and air right in the radiator and results in low radiator temperatures in mild weather . . . without resort to high vacuum. Individual control at the radiator is provided by the Webster Supply Valve. A Webster Radiator Trap keeps the radiator freed of condensation at all times.



TYPICAL ARRANGEMENT OF ELECTRONIC MODERATOR SYSTEM

Fig. 3. Diagram of Webster Electronic Moderator System using a single Main Steam Control Valve.
Not to be used for installation. Webster Service Details are furnished with equipment.

WHAT IS THE WEBSTER ELECTRONIC MODERATOR SYSTEM?

The Webster Electronic Moderator Control is an electrically operated central control providing continuous but automatically graduated or throttled steam flow to all radiators. It is literally "controlled by the weather." An Outdoor Thermostat automatically varies the rate of steam delivery to radiators with changes in outdoor temperature. A Variator, manually operated (shown in Fig. 6), modifies the action of the Outdoor Thermostat for such requirements as quick heating-up, changes in occupancy, and weather conditions other than temperature. Experience has shown that greater economy is possible when these factors are provided for by manual adjustment. Optional equipment to provide completely automatic operation includes: (1) pilot light on Variator; (2) automatic overheat limit Indoor Thermostat; and (3) electric time switch for automatic heating-up, return to normal, and shut-off.

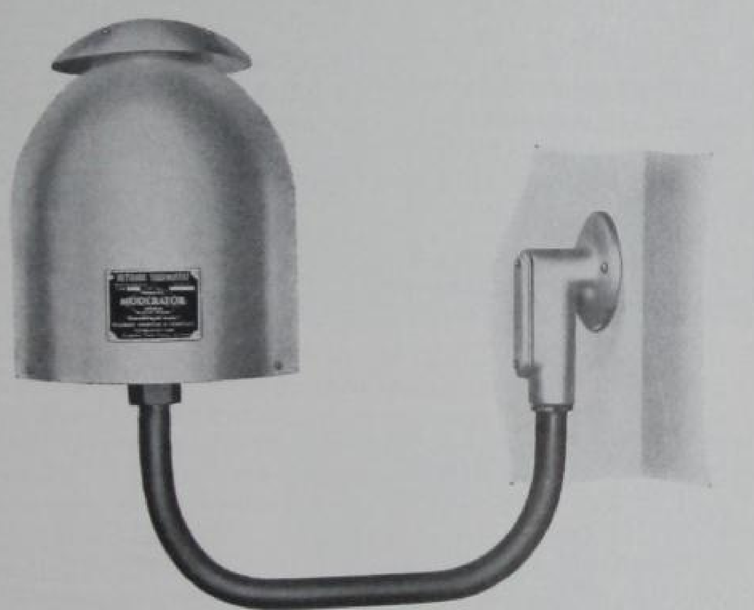


Fig. 4. AUTOMATIC OUTDOOR THERMOSTAT. 8⅞" diameter by 11½" high. Interior parts are mounted on cast iron base and sealed by a metal housing. Entire device is protected from direct rays of sun by a metal shield. Ample space between shield and housing is provided for air circulation. Thermostatic element is a bimetallic coil expanding and contracting to move a contact arm over an electrical resistance. Change in resistance energizes control valve motor which adjusts the Control Valve. At 70° F. or higher outdoor temperature, the Control Valve is completely closed.

Installation—Placed on roof or outside wall using vertical pipe stand or horizontal bracket of conduit with condulet. Fittings for mounting not furnished with thermostat. Approximate weight is 8 lbs.

A typical arrangement (Fig. 3) uses a single Webster Main Steam Control Valve. For most installations of average size where occupancy conditions are uniform throughout the building, the single valve arrangement is adequate and will be preferred because of lower first cost. Two valves may be provided with a dual Outdoor Thermostat. For large installations, particularly where occupancy conditions vary in different portions of the building or in different buildings in a group, making a multiplicity of valves desirable, a single Outdoor Thermostat plus a multizone Thermostat Control Cabinet is applied. Where zoning for exposure is desired, two or more valves with separate Outdoor Thermostats may be used.

HOW IT WORKS

For the purpose of describing the Electronic Moderator System, Fig. 3 will be used. Steam may be delivered from high or low-pressure boiler or from any other source. Pressure reducing equipment should be used if initial steam pressure exceeds 15 lb. per sq. in. or more. Return piping may be either "open" or "closed," as the Electronic Moderator Control regulates the pressure difference between supply and return, and will function equally well regardless of whether the pressure in the return piping is at atmosphere or below.

The Main Steam Control Valve is adjusted automatically by the Electronic Moderator Control. The valve is motor operated. The Moderator Control serves simply to reverse the direction of the valve motor, causing it to move the valve in the closing direction when less steam is required and in the opening direction when more steam is required.

The electrical Outdoor Thermostat provides the automatic "Control-by-the-Weather" feature, varying steam flow in accordance with changes in outdoor temperature. At 70° F. outdoor temperature, the Main Steam Control Valve will close. At the extreme of

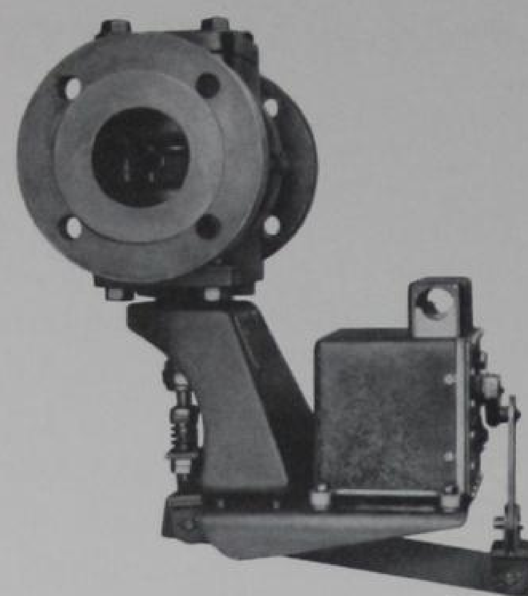


Fig. 5. TYPE "E" MAIN STEAM CONTROL VALVE, furnished for Webster E-5 Electronic Moderator Systems in sizes from 1¼" to 12". Serves to throttle amount of steam admitted to heating system to maintain proper pressure differential across system in accordance with demand. Installed in main steam supply pipe ahead of all units of radiation. The Webster E-1N Model B Valve shown is 4" size. Note that motor is mounted below and well to the side for accessibility. Construction of bracket provides minimum heat conduction from main to motor.

Symbol E-1N Model B Valves, as illustrated, are provided for 2½" to 6" sizes, inclusive. Bodies are of high tensile cast iron, globe pattern, semi-balanced disc, double-seat type. Bodies are flanged for standard 125 lbs. Valves are equipped with phosphor bronze disc cage and renewable seats. The motor is mounted below and at the side of the valve by means of a combination part cast and part pressed steel bracket.

All models are regularly furnished with motors mounted on the left-hand side, viewed from the inlet side of the valve body as shown. If installation arrangements make it desirable to have valve bracket and motor on the right-hand side, this change can be made in the field.

Type E-1 is supplied in 8", 10" and 12" sizes. Type E-2N in 2" and smaller.

0° F. outdoor temperature (or −10° F. or +10° F. etc., depending on climate), the Outdoor Thermostat will cause the valve to open sufficiently to keep the radiators filled with steam. At intermediate outdoor temperatures, the Main Steam Valve is adjusted proportionately and radiators are fractionally or partially filled with steam. The position of the Control Valve thus selected automatically by the Outdoor Thermostat may be advanced or reduced by the Variator to give more or less steam than is called for by the outdoor temperature.

COMPENSATION FOR PRESSURE CHANGES

Fluctuations in boiler pressure, in vacuum, in number of radiators turned on, etc., change the pressure difference in the heating system from that called for by the joint action of Outdoor Thermostat and Variator. These changes in pressure difference are compensated for automatically by a pressure-actuated mercury "U" tube in the Control Cabinet.

One end of this "U" tube is connected to the steam supply main and the other end to the return main (see Fig. 3). If, for example, the supply pressure is unduly increased, mercury rises in the "U" tube to unbalance resistance contained therein, and the Main Steam Valve begins to close. When the pressure difference decreases to that called for by the control equipment, the resistances are balanced and the Main Steam Valve stops. A reverse action takes place when the pressure difference falls below that called for by the control equipment.

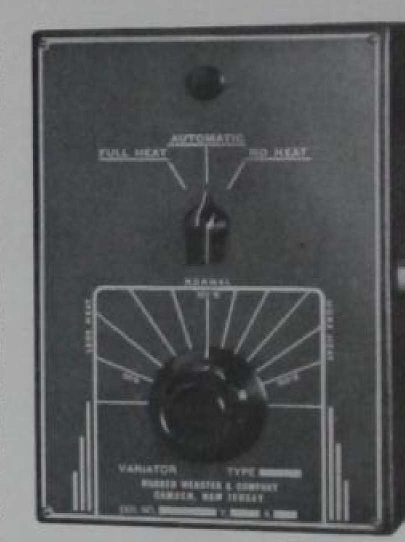


Fig. 6. VARIATOR. A small metal cabinet $6\frac{5}{16}$" x 11⅞" x 5" in size with lock, containing (1) adjustable knob for manual control of the steam supply, and (2) 3-way switch to close Main Steam Control Valve, to place valve under automatic control of Outdoor Thermostat and Variator, and to open valve at full heat position, and (3) (optional) operating schedule card holder. One Variator required for each valve controlled.

Operation—Modifies action of Outdoor Thermostat. Turning knob to left reduces steam supply; turning right increases supply by desired percentage. Used principally for heating-up during early morning hours and for reduced evening or night heating. Occasionally for exceptional weather conditions such as winds, hot sun, cloudiness, etc. However, "normal" setting will take care of average conditions of wind, sun and shade.

Installation—Can be located on wall at any convenient operating station—the boiler room, superintendent's office, beside private exchange, etc. Approximate weight, 7 lbs.

DESIGN REQUIREMENTS

To design a Webster Moderator System, the usual methods of radiator selection and pipe sizing are followed. The Webster E-1N Control Valve or Valves can be selected from Table I using a pressure drop through the valve of 3 pounds per square inch.

Installation—Control Cabinet is bolted or screwed to wall near Control Valve. Electrical service (100 watts, 110 volts, 60 cycles a-c) to operate control system is brought through transformer (110-24) to this cabinet. For d-c, a Rotary Converter should be provided. Piping connections made from cabinet to steam and return mains. A Webster 00026-0 Drip Trap, Relief Valve and Check Valve are included. Approximate weight, 70 lbs.

TABLE I—CAPACITY IN LBS. PER HOUR OF WEBSTER MAIN STEAM CONTROL VALVES

Valve Size, Inches	Shpg. Wt., Lbs.	PRESSURE DROP ACROSS VALVE*					
		1	2	3	4	5	10
1¼	26	210	294	364	417	468	660
1½	28	303	430	525	608	678	958
2	30	485	692	845	985	1090	1620
2½	130	600	820	985	1120	1200	1600
3	145	913	1250	1510	1700	1800	2450
3½	165	1210	1650	2000	2260	2450	3100
4	180	1570	2140	2590	2930	3100	4050
5	210	2450	3360	4060	4600	4950	6400
6	270	3570	4860	5880	6660	7200	9300
8	450	6220	8500	10300	11600	12500	16500
10	775	8900	12200	14700	16600	18000	23500
12	1100	13700	18700	22600	25600	27500	35550

*Pressure drop across valve equals initial steam pressure minus maximum steam delivery pressure on system side of valve.

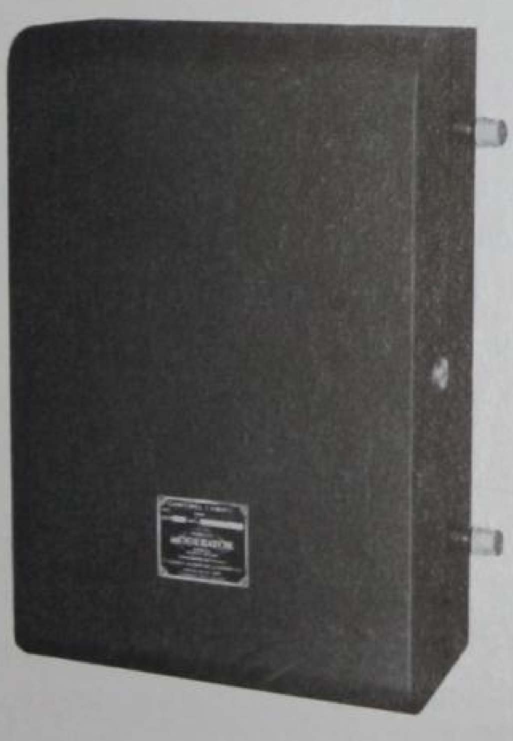


Fig. 7. PRESSURE CONTROL CABINET. Contains standard electrical apparatus such as resistances, relays, etc., in addition to specially designed mercury contact "U" tube. Has hinged cover for accessibility, with lock. One cabinet required for each valve controlled. Type E-5 Pressure Control Cabinet is 14" x 22" x 7" in size.

Each heating zone requires a separate Variator and Control Cabinet. An Outdoor Thermostat must be provided for each zone. This can be accomplished with an individual Outdoor Thermostat or a Dual Outdoor Thermostat for 2 valves or with an Outdoor Thermostat and a Thermostat Control Cabinet for 3 or more.

Day and night control, automatic morning pick-up limit controls, and other accessories can be specified as considered necessary. Desired operating requirements can be met by incorporating into the control system one or more of the items of optional equipment mentioned earlier.

It is important in designing the control system to properly locate the control units and to provide adequate work room around this equipment. Dimensions can be obtained from appropriate Webster Service Details.

Care should be used in locating the Control Cabinets and Variators so that they will be convenient for use by the designated operators, yet so located that unauthorized persons will not interfere with them. All control units are provided with secure locks and keys to prevent unauthorized operation.

If convectors are used, it is important to select convectors with heating elements which can be provided with orifices without difficulty. While most convectors are manufactured to meet these requirements, there are exceptions which must be avoided if the system is to operate. For end feed convectors, cup type orifices are normally used. On bottom feed convectors, tube type orifices are necessary to avoid noise. Cup type orifices are normally used on cast iron radiation and tube type orifices for fin type radiation.

The sizing of the orifices is done by the Webster Representative after order for the materials has been received from the contractor. The orifice sizing is not considered a function of the initial design. All that is required of the engineer is specification of the *type* of orifices required.

SPECIFICATIONS FOR WEBSTER E-5 ELECTRONIC MODERATOR CONTROL

General

The control system shall be capable of varying and controlling the pressure difference between the supply and return mains in relation to outdoor temperature changes. There shall be continuous flow of steam to the system with full or fractional heating of radiators at all times when heat is on, accomplished by an electrical balance between Outdoor Thermostat, Control Cabinet, and Variator. Steam is to be admitted to the heating system through a motor-operated control valve. There shall be installed in the supply connection to each radiator an orifice to maintain even heat distribution.

This contract is to include all material, labor, permits, etc., necessary for the complete installation of the control system. All materials must be new and installed according to the best practice.

The contractor must comply with all state and city ordinances and rules governing work of this character. He shall also be responsible for any accident to men, material or property until the control system has been accepted by the owners.

It is not intended that the drawings shall show every pipe, fitting and appliance, and it is understood that while the drawings must be followed as closely as circumstances will permit, the contractor is held responsible for the proper installation according to the true intent and meaning of plans and specifications.

All cutting of walls, floors, etc., necessary to accommodate the work shall be done by the contractor and he shall refinish same to meet the approval of the owner.

Outdoor Thermostat

The Outdoor Thermostat shall consist of a bimetallic coil element which operates a contact arm over a wire-wound resistance element in response to changes in temperature. Changes in outdoor temperature change the value of the electrical resistance which is connected electrically to the Control Cabinet.

The bimetallic assembly is to be mounted on a cast base and a cover of spun aluminum is to enclose the entire assembly.

The Outdoor Thermostat shall be mounted on the north wall outside of the building or as indicated on plans in location as approved by Warren Webster & Company.

Control Cabinet

The Control Cabinet shall consist of a steel box with hinged door and painted with black crystalline enamel. The cabinet shall be located as near the Control Valves as possible.

The cabinet shall house a mercury pressure tube and contactless electronic relay. The cabinet is to be connected by piping to the supply and return mains. The Outdoor Thermostat and Control Valves, etc., shall be connected as specified and shown on plans. All piping and electrical connections shall be made in accordance with the details as furnished by Warren Webster & Company.

Variator

The Variator shall have an adjusting dial. The dial is to be marked "Normal," "More Heat," and "Less Heat." There shall also be a three-position switch for manually setting the control to "Full Heat," "Automatic" or "No Heat."

The Variator is to be used as a manual adjustment to vary the heat input for sub-normal or abnormal weather conditions.

Control Valve

The Control Valve is to be installed where shown on plans and is to be electrically connected to other equipment. Control Valve motors are to be heavy-duty, oil-immersed, modulating, low-voltage type. The motor

shall be connected to the valve stem by appropriate linkage. All valve bodies are to be 125-lb. design and constructed to operate satisfactory on 15-lb. saturated steam pressure. Valve sizes 1″ to 2″ are to be single seated, brass body, with bronze valve piece, screwed type. Valves 2½″ and larger shall be high tensile cast iron body, double seated, with brass trim, flanged type. Valve seats are to be renewable.

Radiator Orifices

There shall be installed in each radiator supply connection Webster metering orifices of a type suitable for installation in the radiation supplied. These orifices shall be accurately sized for the heat loss and distance from the source of supply. Orifices shall be installed in accordance with locations shown on plans.

Wiring

All wiring shall be done by the contractor in accordance with details furnished by Warren Webster & Company. All labor and material required to make a complete job shall be furnished by the contractor. All wiring except service to transformer shall carry 24 volts. The transformer shall be mounted in a standard metal box. The 115 volts service line to transformer shall be equipped with switch and 6-ampere fuses. All wiring shall be done in strict accordance with state and city ordinances regarding work of this character.

Inspection

Upon completion of all of the work, a representative of Warren Webster & Company shall inspect same and put control system in operation. Should this inspection disclose any defects in workmanship, materials, etc., then the contractor shall rectify same at no expense to the owner. Complete operating instructions shall be given the operators when the system is placed in operation by a Warren Webster & Company Representative.

Guarantee

All materials and workmanship shall be guaranteed for a period of one year from date of acceptance.

OPERATING AND SERVICING DATA

Complete bulletins providing all details of installation, operation and servicing accompany all Webster Electronic Moderator System equipment.

These bulletins include a suggested form for a daily Heating Log and show how to operate this system to meet varied conditions within heating area.

THE COMPANY

Warren Webster & Company have specialized for more than sixty years in the field of steam circulation and steam distribution, particularly vacuum, vapor and low-pressure steam heating of buildings, and medium-pressure steam in industrial and process heating applications.

This specialized experience is available through trained engineers at the Home Office and through the Representatives listed on inside back cover. These Representatives are thoroughly conversant with methods and equipment to control steam distribution and heat transfer, assuring maximum heating effectiveness with minimum fuel or steam consumption. Webster Representatives are prepared to supply on request full technical, availability and price information on all Webster Systems and products. For information beyond the scope of this bulletin, please communicate with the Representative nearest you.

▲ Air-conditioned Dun & Bradstreet Building. Steam, effectively controlled by a Webster Moderator System in two zones, assures comfort heating for first-floor stores. As with almost every outstanding Manhattan building, steam is the foundation for all heat requirements. Architects: Reinhard, Hofmeister & Walquist. Consulting Engineers: Syska & Hennessy. Heating and Air-Conditioning Contractors: Kerby Saunders, Inc. General Contractor: George A. Fuller Company.

▲ The Travelers Insurance Co. building group, Hartford, Conn., completed a well-planned heating modernization program in 1948. It includes a Webster Moderator System with an 11-zone centrally located control panel and a new boiler plant. Savings of approximately 40% were indicated. Architects: Voorhees, Walker, Foley & Smith. Consulting Engineers: Meyer, Strong & Jones. Heating Contractor: Libby & Blinn, Inc.

▲ Port Authority Bus Terminal, New York City, has a 7-zone Webster Moderator System for tenant-occupied spaces, shops and offices. It's the fifth New York Port Authority building with a Webster Moderator System. Builders: Turner Construction Co. Heating Contractor: Riggs Distler & Co., Inc., New York.

WEBSTER MODERATOR SYSTEM MEETS VARIED HEATING REQUIREMENTS

▲ Park View Apartments, Collingswood, N. J., is the largest post-wa apartment in the Philadelphia area. The Webster Moderator System balanc heat delivery to fully recessed Webster System Radiators in each apartmen There's a Webster Radiator Valve for 100% heat shut-off from each co vector—no dampers are needed. Architects: J. Raymond Knopf and Samu J. Oshiver (associate). Builders: S. J. Lowery and E. J. Frankel. Engineer Robert E. McLoughlin, Salvatore S. Guzzardi, and Robertson and Johnso Heating Contractor: Benjamin Lessner Co., Inc.

▲ Warehouse of Great Atlantic & Pacific Tea Company, Albany, N. Y., use the Webster Moderator System to meet three basic requirements of goo warehouse heating—economy, effective heat distribution, maintenance-fre operation. Heating Contractor: E. W. Tompkins Company, Inc.

▲ Delaware Hospital, Wilmington, Del., completed in 1942, effects maximu heating economies with a 6-zone Webster Moderator System and caref plant operation. Controllability, a feature of the Moderator System, pr vents wasteful overheating. Architects: Massena & duPont, Wilmingto Consulting Engineers: Jaros, Baum & Bolles, New York. General Contracto Turner Construction Co., Philadelphia. Heating Contractor: Benjamin Shaw Co., Wilmington.

For Webster Service . . .

WARREN WEBSTER & COMPANY

FACTORY AND MAIN OFFICE: 17TH AND FEDERAL STREETS, CAMDEN 5, N. J.

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REPRESENTATIVES ARE LOCATED AT THE ADDRESSES BELOW—FOR TELEPHONE NUMBER, LOOK FOR WARREN WEBSTER & COMPANY IN YOUR LOCAL TELEPHONE BOOK

ALBANY 6, N. Y.
H. A. Bond
332 Central Ave.

ATLANTA 3, GA.
E. W. Klein & Co.
152 Nassau St., N. W.

ATLANTIC CITY, N. J.
B. H. Strouse
630 Guarantee Trust Bldg.
N. Carolina & Atlantic Aves.

BALTIMORE 18, MD.
H. M. Harris
2301 N. Charles St.

BETHLEHEM, PA.
E. K. Webster, Jr.
1020 Highland Ave.

BIRMINGHAM 3, ALA.
Haydn Myer Co., Inc.
2224 Comer Bldg.

BOSTON 10, MASS.
J. F. Tuttle Co.
Room 21
127 Federal St.

BRUNSWICK, ME.
Under Boston
C. Claud Clark
Box 476

BUFFALO 2, N. Y.
Howard P. Asmus
502 Jackson Bldg.
220 Delaware Ave.

BUTTE, MONT.
Sullivan Valve & Engr. Co.
909 E. 2nd St.
P. O. Box 1931

CHATTANOOGA 2, TENN.
Under Indianapolis
C. E. Mills
720 James Bldg.
735 Broad St.

CHICAGO 6, ILL.
P. W. Stickney
506 Machinery Hall Bldg.
549 W. Washington Blvd.

CINCINNATI 6, OHIO
G. B. Houliston
2910 Woodburn Ave.

CLEVELAND 15, OHIO
A. L. Vanderhoof
233 Hanna Bldg.
1401 Prospect Ave.

COLUMBIA, S. C.
Under Atlanta
R. F. Donovan
P. O. Box 5204
401 Wildwood Ave.

COLUMBUS 15, OHIO
Robert A. Wilson
228 Lanman Bldg.
20 S. Third St.

DALLAS 4, TEXAS
J. R. Dowdell & Co.
P. O. Box 507
4024 Swiss Ave.

DAVENPORT, IOWA
H. H. Evanson
320 Western Ave.

DAYTON 2, OHIO
Under Cincinnati
C. D. Weaver, Jr.
1136 U. B. Bldg.

DENVER 4, COLO.
H. H. Herman
1228 California St.

DES MOINES 9, IOWA
H. E. Drain
506 Securities Bldg.
418 Seventh St.

DETROIT 2, MICH.
A. B. Knight
Room 1, Melwood Bldg.
8316 Woodward Ave.

GRAND RAPIDS 2, MICH.
Hero D. Bratt
331 Ottawa Ave., N. W.

HARRISBURG, PA.
Fred W. Schimmel
835 S. 13th St.

HOUSTON 1, TEXAS
Ralph B. Johnson
1017 Rosine St.
P. O. Box 1961

INDIANAPOLIS 4, IND.
S. E. Fenstermaker
937 Archts. & Bldrs. Bldg.
333 N. Pennsylvania St.

KANSAS CITY 8, MO.
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3252 Roanoke Rd.

KINGSTON, PA.
Arthur H. Ross
Room 210
303 Market St.

LOS ANGELES 13, CALIF.
R. M. Gunzel
320 Crocker St.

LOUISVILLE 4, KY.
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Clarke Kaye & Co.
519 Barret Ave.

LUBBOCK, TEXAS
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MILWAUKEE 3, WIS.
A. M. Freeman
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161 W. Wisconsin Ave.

MINNEAPOLIS 3, MINN.
H. E. Gerrish
370 Insurance Bldg.
1111 Nicollet Ave.

NEWARK 2, N. J.
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Room 357
1060 Broad St.

NEW HAVEN 10, CONN.
H. R. Briggs
Room 614
902 Chapel St.

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To protect ourselves in our constant endeavor to make Webster Systems of Steam Heating and Webster System Equipment ever better, we reserve the right to change specifications and prices without notice.

Printed in U.S.A.

Bulletin B-900-4B—January, 1953—10M—F

WEBSTER

MODERATOR

TRADE MARK REG. U.S. PAT. OFF.

SYSTEM

OF STEAM HEATING

"Controlled by the weather"

THE WEBSTER
EH-10 MODERATOR SYSTEM
OF STEAM HEATING

"Controlled by the weather"

The Webster EH-10 Moderator System is a steam heating control of the "pulsating flow" type for new or existing buildings. With the EH-10 Moderator Control steam is delivered to all radiators of the system during "on" intervals at a fixed pressure difference. These "on" intervals occur frequently—every thirty minutes in the average installation, but alternate gear trains are available without extra cost to provide for other intervals from twelve to sixty minutes. The length of the "on" interval ranges from zero minutes, or steam off entirely when the outdoor temperature is at 70° F. or at other maximum temperature if desired, to "on" a full thirty minutes or 100% of the time when the outdoor temperature is 0° F., or at any other selected minimum. The length of "on" interval is varied automatically by an Outdoor Thermostat. However, the automatically selected length of "on" interval may be modified manually through a knob conveniently mounted on the Control Cabinet. The results produced by the EH-10 Moderator System include avoidance of overheating and underheating, elimination of "cold 70" which results with controls which produce long "off" intervals and short "on" intervals in variable cycles. Substantial fuel savings result in installations which have previously been overheated due to inadequacy of control means.

Where Used

The Webster EH-10 Moderator Control is designed chiefly for the small and medium sized building, and for zoning in larger buildings. It may directly control operation of burner, stoker or blower motor. It is also applicable to a motorized Webster Control Valve placed in the steam supply main of the building served by a boiler or by "street" steam.

While used most frequently on two-pipe steam heating systems, the EH-10 System may also be applied to advantage on certain one-pipe installations.

Like other Webster Moderator Systems the EH-10 can be applied to open return systems using Webster Boiler Return Trap or condensate pump, and to vacuum steam heating.

Equipment Available

The minimum equipment for an EH-10 System includes a Pressure Difference Controller, a Control Cabinet with an Outdoor Thermostat attached by capillary tubing and orifices in radiator supply connection. These units work together to open and close a Webster Control Valve in the steam main or to start and stop the automatic firing device at the boiler, generally through a relay. Optional equipment may include a schedule clock for automatic turn-on at heating up rate, return to normal operation, and night shut off or an indoor thermostat with or without clock.

A feature of the Webster EH-10 System is the Pressure Difference Controller which maintains the correct pressure difference between supply and return piping. In combination with Webster Metering Orifices, this device assures even distribution of steam to all radiators and prevents the over-heating and under-heating that has been characteristic of controls not incorporating these features.

How It Works

Control is accomplished by varying the length of intervals during which steam is delivered to radiators.

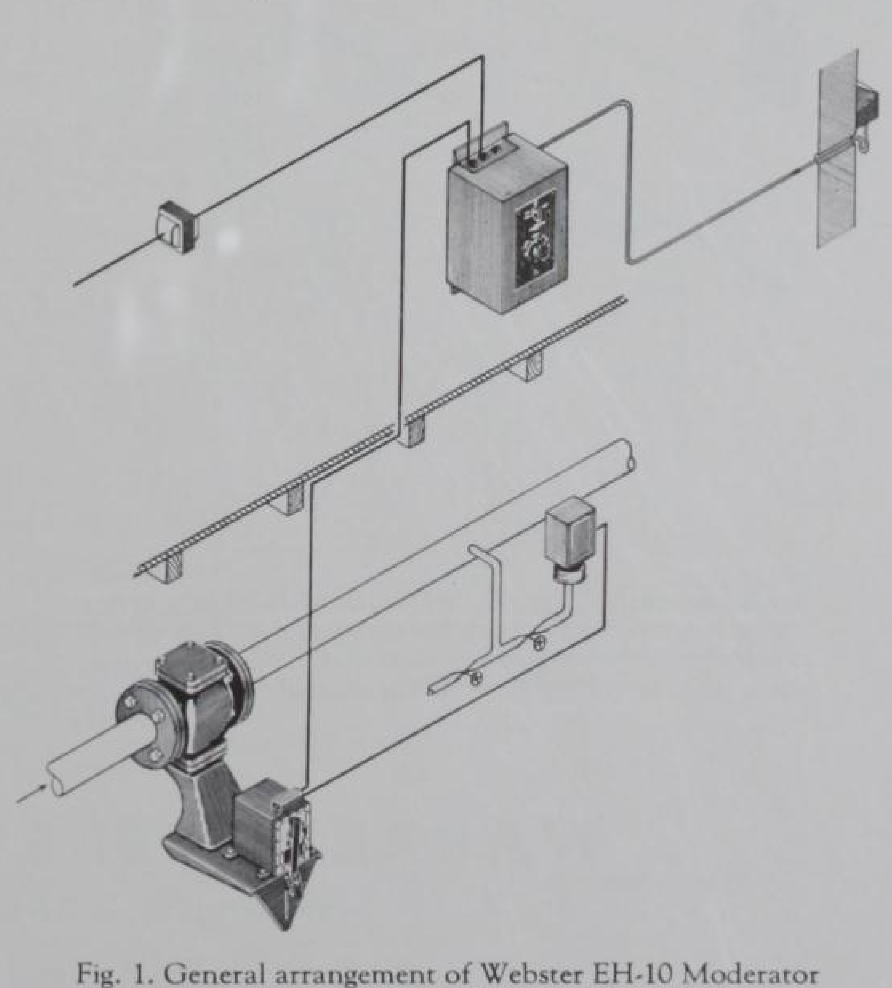


Fig. 1. General arrangement of Webster EH-10 Moderator System controlling motorized Webster Control Valve in steam main of building served by central station or "street" steam

CONTINUED ON OPPOSITE PAGE

These intervals are longest in cold weather and shortest in mild weather. However, the longest "off" interval is comparatively short so that heat output from radiators is practically continuous.

The timing mechanism inside the cabinet is actuated by a synchronous motor which turns a cam. Timing gears between motor and cam determine the length of the operating cycle. Riding on the cam is a roller connected to the arm of a switch. When the roller is on the "high" part of the cam, the switch is in the position for opening control valve or starting firing equipment. When the roller is on the "low" part of cam, the switch is in the position for closing the control valve or stopping the firing equipment. The length of the ON interval is changed automatically by the Outdoor Thermostat or by adjusting the Variator by hand. The usual length of cycle is 30 minutes. Other gears can be furnished for cycle lengths from 12 to 60 minutes.

The Control Cabinet includes in addition to the Variator, a switch for manual selection of "OFF", "AUTOMATIC" or "FULL HEAT" positions, and a bull's-eye light which is "ON" when control is in operation.

The Outdoor Thermostat is a liquid-filled bulb connected to an expanding element in Control Cabinet by capillary tubing. Change in outdoor temperature

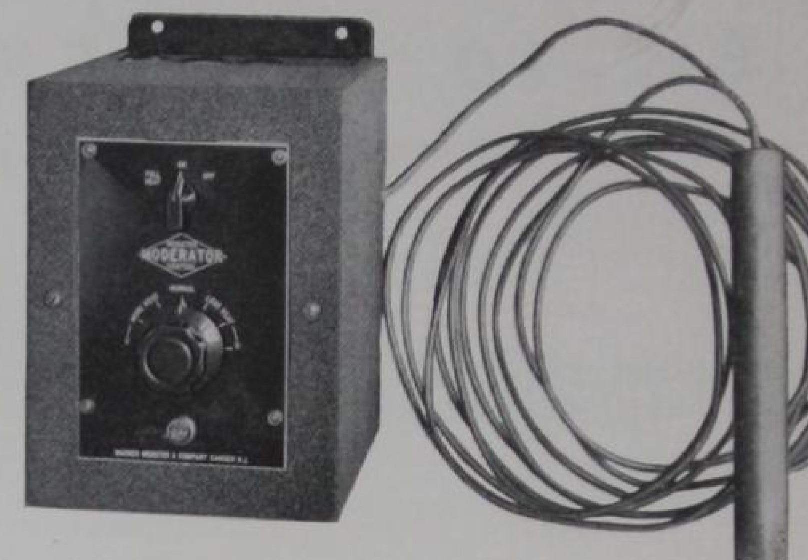


Fig. 3. Webster EH-10 Moderator Control Cabinet and Outdoor Thermostat which provides automatic heat variation. Control Cabinet is approximately 7½ In. Wide, 11⅞ In. High, and 7¼ In. Deep. Weight is 17 Lbs.

expands or contracts the element which changes relationship of the switch arm and roller to the cam by moving the switch. This relationship governs the length of the ON period. When the outdoor temperature is 70° F. or higher, steam will be shut off automatically provided the Variator is at NORMAL.

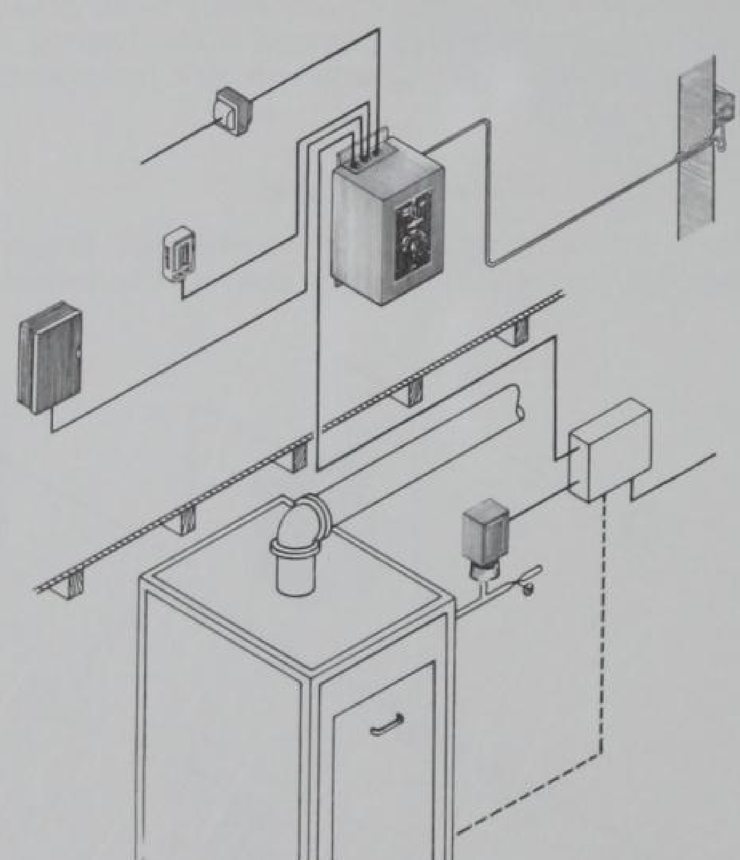
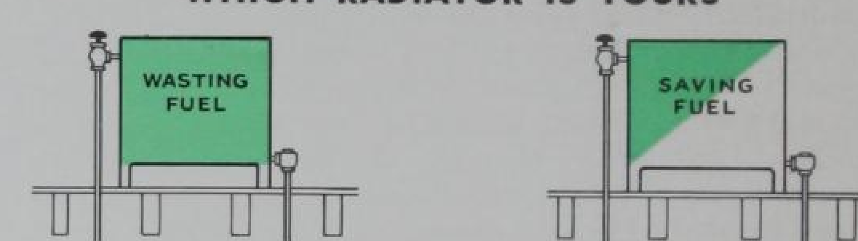


Fig. 2. General arrangement of Webster EH-10 Moderator System controlling burner of steam boiler. Time Switch and Indoor Thermostat are optional. Similar arrangements are used for stoker or blower control

WHICH RADIATOR IS YOURS



Excess amount of steam for 43° outside temperature
APPROXIMATE WASTE 67%

Correct amount of steam for 43° outside temperature
NO WASTE

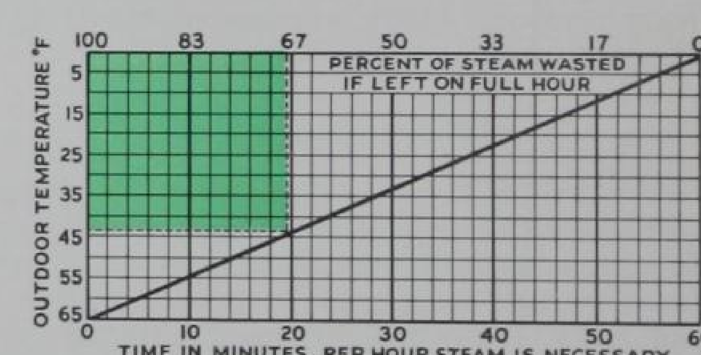


Fig. 4. This chart illustrates the waste that may occur when radiators are continuously filled with steam except in coldest weather. Note the dotted lines. At 43° outside temperature, the waste is nearly 67%. The Webster Moderator System prevents this waste by furnishing the proper amount of heat at all times

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Webster

Continuous flow control for hot water heating

"meets the weather outside the door . . ."

BULLETIN B-200B

WARREN WEBSTER & COMPANY
CAMDEN 5, NEW JERSEY

Control of your heating system

Control of a heating system is like control of any other kind. Control can be very simple . . . or very complex. It is a far cry from riding bareback, with control limited to the pressure on the neck of the horse, to driving a modern luxury motor car with power steering, power brakes, and autronic eye. Yet, essentially, these are really *degrees* of differences in control.

The simple open fireplace is a popular means of heating, yet there are few forms of heating that are less effectively controlled. About all you can do is put on another log and stir up the fire, or let it die down.

The older, hand-fired coal heating systems could be directly controlled only to a very limited extent —by varying the rate at which the coal is added or by varying the draft, or the rate at which air was fed through the fire. If the coal was used to generate steam, an added degree of control could be effected by regulating the pressure of the steam. Moreover, if the steam was distributed to radiators, then a further control could be provided by radiator valves. These are mostly manual but may be automatic, as, for example, when pneumatic valves are actuated by room thermostats.

With the advent of stokers for burning coal, oil burners and gas fuel, some sort of automatic control became an absolute necessity. The early forms of such control were primitive and many of them are still "on and off," "stop and go" devices. Even these do satisfy the minimum requirements of safety and they provide some degree of economy. They fall far short, however, of providing anything like the ultimate in comfort.

Continuous flow and outdoor thermostat pioneered by Webster

With a clear understanding of the fundamentals and a background of previous knowledge of heating system control, Webster engineers started early in the 1920's the development of what later became known as the Webster Moderator Systems of Steam Heating. Basic to that development program were these two fundamental requirements:

(1) Continuous heating, fully controlled
(2) Heating at a rate varying with the need for heat through control by a *thermostat located outdoors*

These two fundamentals, incorporated in every Webster Moderator Control for more than 26 years, are both now widely copied—a fact that is in itself conclusive evidence of Webster "know-how" on the subject of heating.

In fact, the only reason that continuous flow with outdoor thermostat control was not long ago universal is that the design and construction of a satisfactory device requires a high degree of skill and in addition, the purchase of this truly adequate and effective comfort control involves a larger sum than is required for a simple "on and off" control. Moreover, many thousands of home owners and prospective home owners who can readily afford this quality of control have been so mystified and confused by trick sales phrases that they have not availed themselves of this really sound investment.

Webster CF hot water control

More than six years ago Webster engineers produced a continuous flow control for forced circulation hot water heating. This control, refined and perfected, has now been proven in a wide variety of installations. In its latest design, the CF Control is a worthwhile feature which should be considered for any forced circulation hot water heating,

for Baseboard Heating
for Convector Heating
for Radiator Heating
for Panel Heating

and, of course, for WEBSTER Baseboard Heating.

For All Types and Sizes of Buildings

Webster CF Hot Water Controls are not limited in application to residential installations. Like the Webster Moderator Systems in the steam heating field they bring to any building, regardless of size and type, the fundamental advantages of:

Control by outdoor temperature with freedom from dependence on control of an inside thermostat located at some given point not representative of requirements throughout.

Control through a few rugged units instead of by devices spread throughout the building.

Control independent of window opening, a sure means to fuel economy in larger buildings particularly.

Webster CF Control has been applied to control of water temperature in large air conditioning installations where hot water is circulated through the air conditioning units in the winter and cold water in the summer. It has been applied to control of steam fed to a heat exchanger where the latter supplies water for a hot water heating system.

Webster Continuous Flow Hot Water Heating Control is used in two new Philadelphia air-conditioned apartment hotels, the Rittenhouse-Savoy (shown above) and the Rittenhouse-Claridge.

Cameron Village, Raleigh, N. C., (above and right). Chosen "Garden Apartment of the Year" for 1949 by the N.A.H.B. Webster Baseboard Heating with Webster Continuous Flow Control and Individual Apartment Control. Similar equipment used in addition built in 1952.

New Braunfels Senior High School, New Braunfels, Texas, has weather-regulated Webster CF Control for fuel economy independent of window opening.

The Long Island home of George R. Hinman, with Webster Continuous Flow Control of three-zone Webster Baseboard System, has heating comfort "like a balmy night in June."

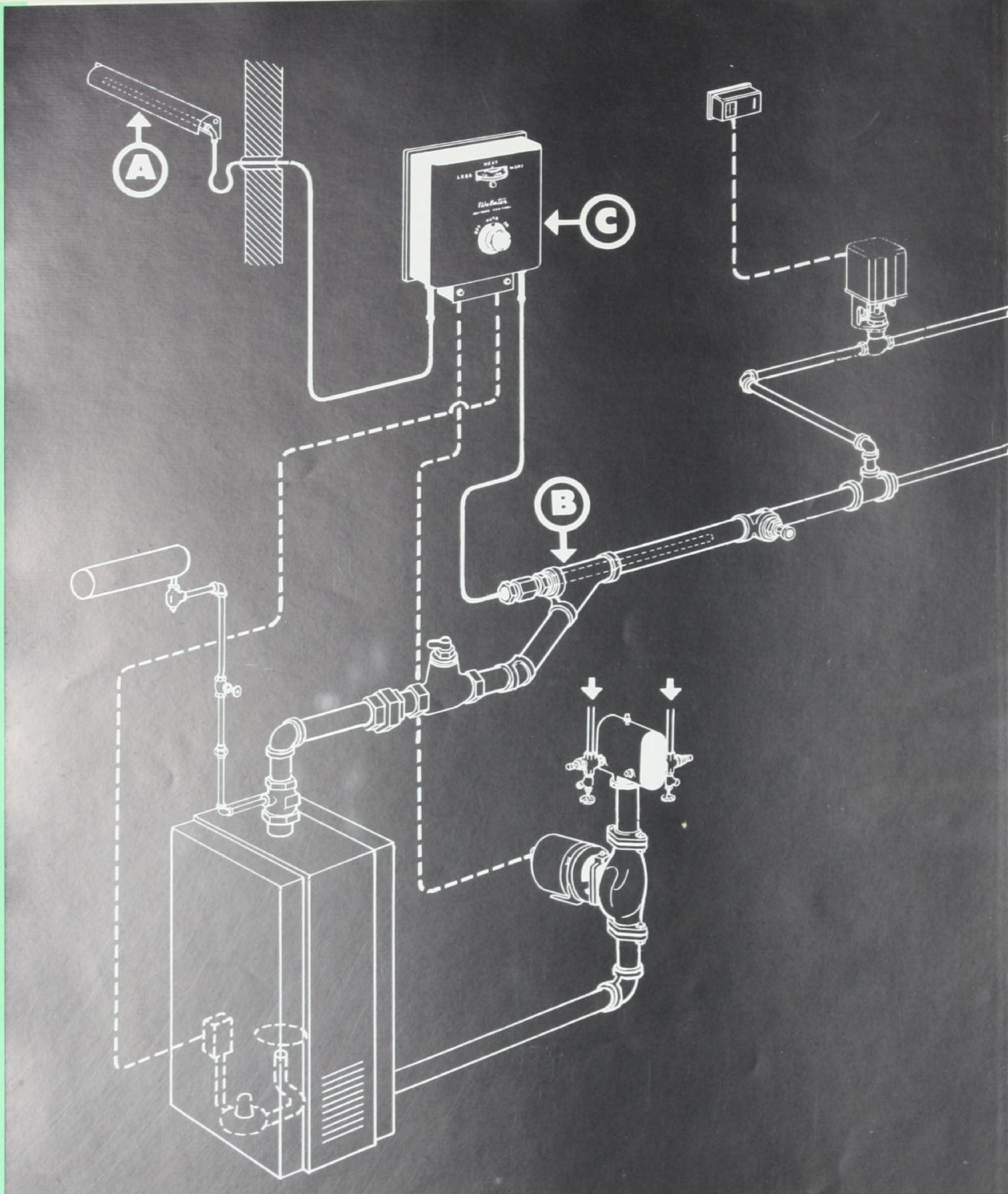

Fig. 1. Arrangement of Webster CF Continuous Flow Hot Water Heating Control, for control of gas flame and circulator.

CF as a basic control

There are many variables possible in the application of the Webster CF Control. The simplest application involves its use as a basic control where the hot water heater serves *only* to supply water for the heating system (in cases like this, the domestic hot water supply must be provided by an independent unit). This basic application is illustrated in Fig. 1, page 4. Here are shown the three components of the CF Control:

(a) An Outdoor Thermostat bulb mounted well up in an inconspicuous location on an outside wall, preferably on a north wall, and protected by an aluminum sun shield from the direct rays of the sun. The function of this thermostat is to "show" the heating system at all times the *outdoor air* temperature.

(b) A Supply Main Bulb in the main through which water flows to the heating system. This bulb in its turn "shows" the control system the temperature of the water available to do the heating job required by the outdoor temperature.

(c) The Control Cabinet. A simple, attractive unit about 9" wide and 10" high, projecting 3" from the wall (unless provided in a flush wall installation). This control unit houses the switches, diaphragms and levers necessary to make the two bulbs do their job. In addition, it provides two convenient manual controls, a SWITCH and a VARIATOR.

Fig. 2. Webster Continuous Flow Hot Water Heating Control Unit, Type CF. This compact unit is contained in an attractive cabinet designed for mounting on wall or column, in the basement or at any other convenient point. Supplied with it are the outdoor and supply main thermostat bulbs and fittings, and a thermometer well for installation in the supply main.

The switch

"OFF" POSITION The switch can be snapped to "Off," thereby completely shutting down the heating system with the possible exception of a pilot light burner where a gas fired heater is concerned.

"ON" POSITION In this position the heating system will run continuously and "full out," regardless of how warm it is outdoors or indoors. The burner will only shut off when the Aquastat, a device which is part of the gas burner control, shuts off the fuel because the water temperature has reached the maximum for which it is set. With the Webster CF Control, the Aquastat is not part of the comfort-creating control but a limiting safety device. The principal use of this "on" position is for quickly heating up a cold house which has been unoccupied for some time with the heat completely turned off.

"AUTOMATIC" POSITION With the switch in this position, the CF Control is in full operation. This is the position in which the switch will remain 99% of the time.

Here is how the basic control just described works in an actual installation. As long as the temperature outdoors is above 70°, the system is completely shut down. In a gas-burning boiler the pilot light will probably be burning, as most gas companies recommend that this be kept on winter and summer to prevent condensation and corrosion of the vent pipe or chimney. The moment the temperature outdoors drops below 70° and before you have become the least bit aware inside of the necessity for heat, the CF Control will start the Circulator and water from the boiler will flow throughout the system. This water at the start may be only 80° or 85° as warmed by the pilot light and a rise in outdoor temperature above 70° may shut down the Circulator before you are aware that your heating system has been on the job. You will not "feel" any heat. On the other hand, neither will you be conscious of any draft or any chilly feeling.

However, when the outdoor temperature moves below 70° and *as long as it remains below 70°* your Circulator will run continuously. This is the basis of continuous flow control heating.

As the outdoor temperature drops, indicating a need for a higher water temperature, the CF Control unit will turn on the burner and raise the water temperature so that the two are always in balance.

Manual variator

This is the second item on the Control Cabinet. It is a dial located in the center and bearing the markings "NORMAL 100." The word "More" is at the right and the word "Less" at the left and there are numbers downward from 100 at the right and upward at the left. In many installations this control will be untouched. However, it is desirable that the control unit be located where it is easily accessible, in a hall near a coat closet, for example. If it is accessible, you will find yourself using it. You may occasionally want higher than NORMAL heat because of small children who are visitors, or because of illness in the house. The movement of this dial from 100 for normal to 110 or 120 will give this result *without in any way impairing the continuous and automatic heating enjoyed when the control is at normal.*

Perhaps you may want to reduce the heat without shutting it off entirely. With the ordinary "on and

off" control, you would set the thermostat back to 60°. With the Webster CF Control, you set the Manual Variator back to 50. This will reduce the amount of fuel used for heating while you are away from the house. But again, it has not interrupted the work of the CF Control. If during your absence the temperature goes above 70° the Circulator will be shut down. If when you leave the temperature is, say 35°, and it later goes up to 60°, the setting on the Variator dial means that 50 per cent of the heat required for an outdoor temperature of 60° will be delivered—no more. If the temperature goes down to 0° the control will increase the amount of heat so as to deliver 50 per cent of the heat required at 0° outdoors.

You can see from the above description what perfection of control is provided by the three simple, reliable components of the Webster CF Control System.

Basic control with summer-winter hook-up

If your heating system is one served by a hot water boiler with summer-winter hook-up, with the same oil burner providing both domestic hot water and hot water for heating, you can obtain the same results as with the basic control just described by the addition of one more unit, a Webster Mixing Valve. This is shown in the illustration of Fig. 3. The CF Control units are connected to the motor on this valve instead of directly to the burner. Through this motor the control continuously provides for a mixture of water newly heated from the boiler with water just returned from the heating system. Once the mixture has been provided at the right temperature, operation is exactly like that of the basic system.

Basic controls plus zoning

In our discussion of the basic control no mention was made of zoning. In many small installations no zoning is warranted. Reduction of heat in bedrooms can be provided through dampers on Webster Baseboard Heating, for example, or through use of a Bypass and a Bypass Valve. Both of these features are fully described in the Webster Baseboard Heating catalog.

Another method of providing reduced heating to bedrooms with the basic control is also shown in the illustration of Fig. 1. The upper loop to the heating system is provided with a motor-operated shut-off valve connected to a clock thermostat in one of the bedrooms. With this addition, without changing in the slightest the operation of the basic system, the heat delivered to the bedrooms can be reduced or held to a lower temperature. The thermostat will shut off the flow of water to the loop serving the bedroom whenever the set temperature is exceeded.

In large installations a complete plan of zoning is desirable. A typical complete zoning arrangement is shown in Fig. 3. Here again the basic control may be without the Mixing Valve, or with it, so that the entire system is provided with a continuous supply of water heated to the degree necessary to meet outdoor temperature requirements. The piping, however, is arranged in three zones.

Zone 1 serves the kitchen, pantry, servant's room and adjacent space.

Zone 2 serves the living rooms including, of course, the dining room and study and the connecting halls and corridors.

Zone 3 serves the bedrooms.

Each of these three zones is under the control of a motor-operated valve connected to a clock thermostat located at some suitable point in the zone served.

There may be some portion of the home, possibly just the bathrooms, or a room for someone who is chronically ill, for which consideration should be given to providing a direct line from the basic control, not under any zone key room thermostat control.

Other applications

In addition to the three control arrangements described, various other applications will be found useful.

One such application is control of steam supply to a converter where steam is available and a hot water system is employed. The CF Control is connected to a motor-operated Webster Type E Valve which modulates the flow of steam to the converter, thus varying the temperature of the water in accordance with changes in outdoor temperature. With this arrangement, one motor-operated valve serves in place of both the Mixing Valve and the Converter Regulator.

Advantages

Many of the advantages of the Webster Type CF Control will have been evident from the description of its application. There are, however, some further advantages which should be noted:

(a) Webster CF Control insures the quietest heating system made. Continuous operation of the Circulator at temperatures below 70° outdoors and gradual change in water temperatures eliminate the possibility of noises that may occur with sudden heating and cooling of piping.

(b) Complete freedom from "Cold 70°." With Webster Continuous Flow Control, there is never the chilly feeling that frequently occurs just before the ordinary indoor thermostat turns heat on and there is never the stuffy feeling and awareness of heat that occurs just before the thermostat shuts off.

(c) Economy results from the elimination of "over ride." Delivering the heat continuously permits

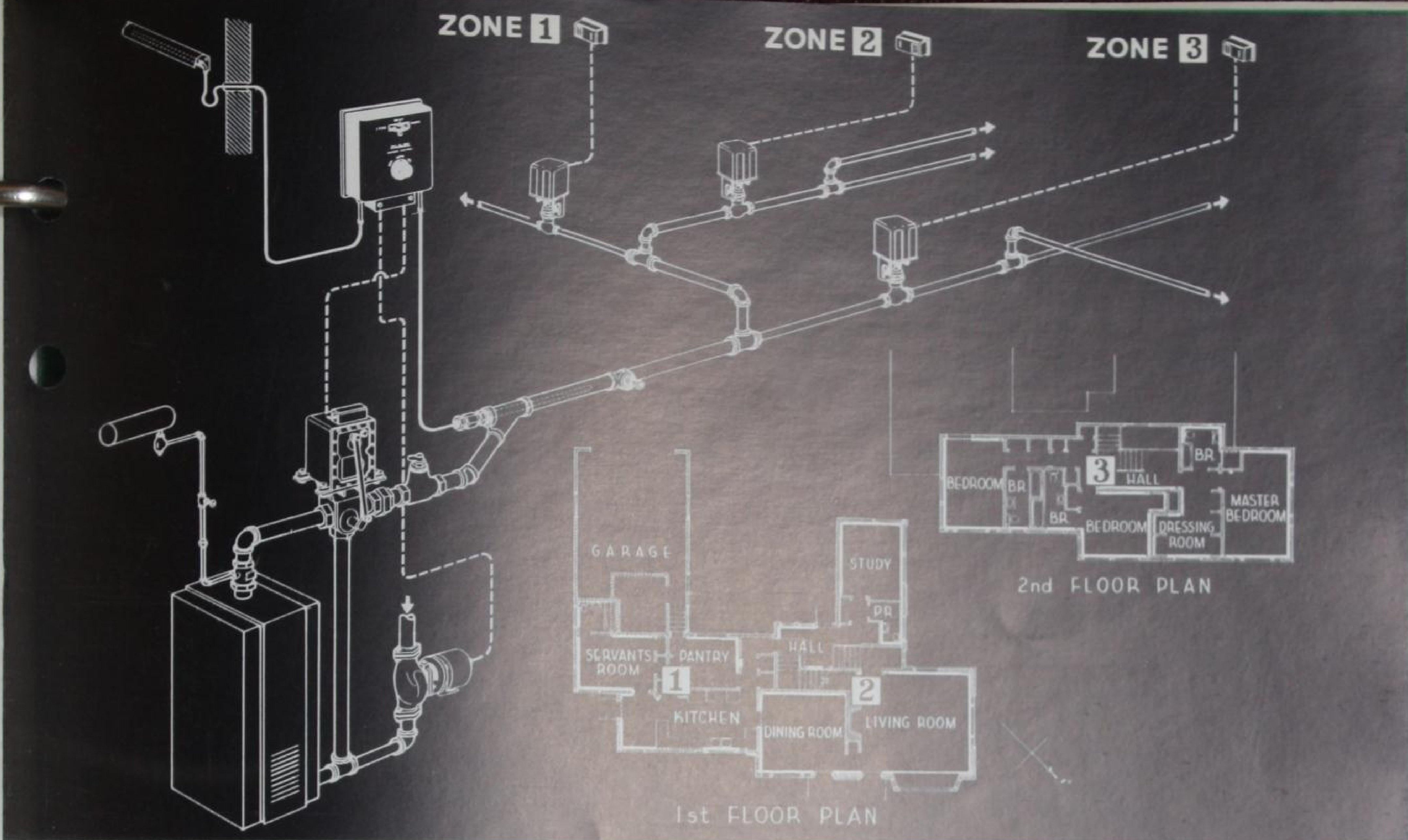

Fig. 3. Typical complete three-zone arrangement of Webster Baseboard Heating, with Webster CF Continuous Flow Control. Each zone is controlled by a motor-operated valve actuated by a thermostat in the zone served.

delivering just enough for the currently prevailing conditions. Excessively heated air is thus never packed up under the ceiling because there is no such thing as excessive heating with the Webster CF Control.

Fig. 4. Outdoor thermostat bulb is protected by an aluminum sun shield. It is connected to the Webster CF Control Unit by 35 feet of capillary tubing. Its function is to "show" the heating system the outdoor air temperature.

Location

The CF Control Unit is provided with ample length of tubing to permit location at a convenient point. Location in a central hall or accessible spot on the main floor is preferred over location in the basement, particularly in homes. The unit may be wall-mounted or flush with the wall.

Control unit

The Webster CF Control Unit is ruggedly designed, and listed by the National Board of Fire Underwriters as an approved temperature regulating device. Underwriters' Approval Label appears on each unit. Rigidity is assured by the use of accurately machined castings. Bearings are of the type used on springless weighing scales and are practically frictionless. Both the automatic and manual switches used in the cabinet are snap action switches. Simple operating instructions are provided on the cover plate below each cabinet. The Outdoor Thermostat Bulb is connected to the Control Unit by 35 feet of capillary tubing. The Hot Water Bulb is connected by 30 feet of tubing. Each unit is individually tested under operating conditions before shipment.

Installation procedure

Webster Continuous Flow Hot Water Heating Control is delivered to your heating contractor, together with Webster Service Details, supplemented by whatever instructions are necessary to enable the contractor to make proper installation.

After the installation has been made and the system is in operation, the contractor or a Webster Service Engineer examines the operation of the installation and makes the adjustments necessary to accommodate the operation of the control to your requirements. The control components have been designed especially to facilitate this adjustment and the incorporation of the adjustable means is one of the outstanding features of the unique design of this Webster Control.

Once made, these adjustments are permanently locked and will normally need no further change unless, of course, the occupancy requirements change materially or there is a change in some important feature of your installation as, for example, the substitution of a stoker for an oil burner, or vice versa.

Specification

The following is suggested specification wording designed to insure the use of a control accomplishing the results which may be expected with Webster Continuous Flow Hot Water Heating Control:

> **ONE COMPONENT** Install as indicated on plans a continuous flow heating control device, acting on the burner to maintain circulating water at a temperature in inverse ratio to the outdoor temperature. Control shall operate to maintain water temperature at ° with outdoor temperature of 0°, reducing the water temperature maintained in straight line ratio as the outdoor temperature increases. Control shall also incorporate automatic shut-off of circulator at outdoor temperature of 70° and shall include manual Variator and three-position switch. The circulator and burner shall be stopped when switch is placed in "OFF" position and circulator and burner shall run when switch is placed in "ON" position disregarding outside temperature. The control unit shall further incorporate a switch which will stop the circulator or circulators when the outdoor temperature reaches 70° F.
>
> **TWO COMPONENTS** Install as indicated on plans, a continuous flow heating control device which will predetermine the temperature of circulating water in accordance with outside temperature requirements. The control unit shall operate the control valve to blend the water from the return main with water from the heat source to produce the desired temperature. The control unit shall include manual Variator and three-position switch providing a choice of automatic operation, full heat or off. The circulator shall stop and control valve close when switch is in "OFF" position. The circulator will run and control valve open fully when the switch is at "ON" position. The control unit shall further incorporate a switch which will stop the circulator or circulators when the outdoor temperature reaches 70° F.

How to obtain the Webster type CF control

Inquiries for further information, prices and deliveries on Webster Continuous Flow Hot Water Heating Control should be addressed to the nearest Webster Representative or to the Company at Camden, New Jersey. The Webster CF Control Unit is specified by architects and engineers and sold and installed by reliable heating contractors. Your architect, engineer or contractor will be glad to obtain further information for you from the Webster Representative.

To protect ourselves in our constant endeavor to make Webster Systems of Steam Heating and Webster System Equipment ever better, we reserve the right to change specifications and prices without notice.

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WARREN WEBSTER & COMPANY
ESTABLISHED 1888 — THE PIONEERS OF VACUUM STEAM HEATING
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PARTMENT, WARREN WEBSTER & COMPANY
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ASSURING CIRCULATION IN "PROCESS STEAM" INSTALLATIONS

The art and science of controlling and circulating steam at extremely low pressures has been developed to a very high state of perfection—probably best exemplified by the Webster "Moderator" System of Steam Heating. In this field it was early learned that *quick, continuous* and *complete discharge of air* and *water of condensation* was an important essential in securing adequate circulation with minimum steam consumption.

The problem of securing the same result at process steam pressures—i. e., 5 to 150 pounds per square inch—is not fundamentally different, but is intensified by the use of various steam chambers and pipe coils of such form and arrangement that the air is not easily discharged.

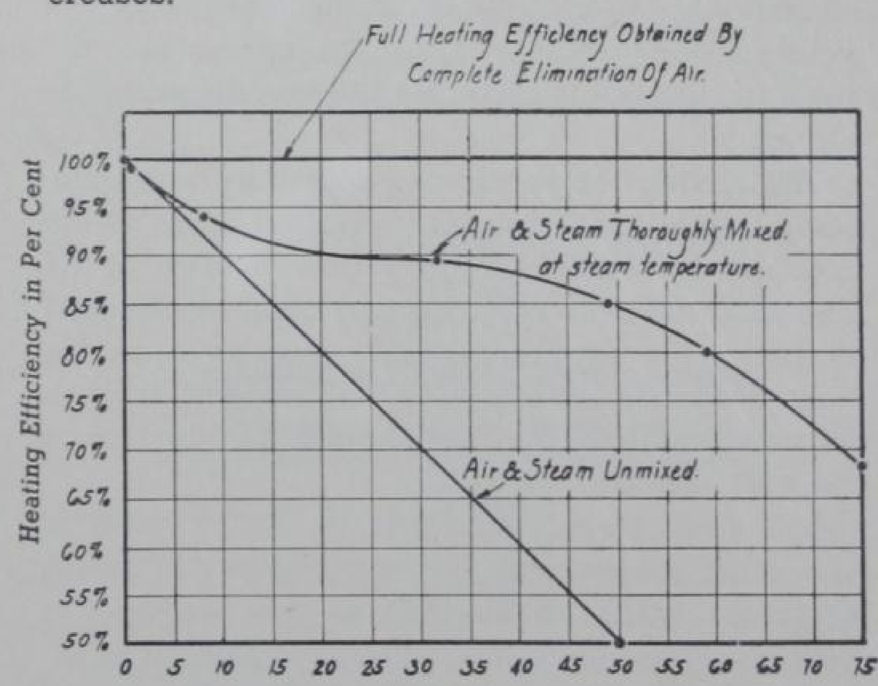
In investigating scores of installations of process-steam-using equipment, Webster engineers have found again and again that *the importance of free and continuous discharge of air has not been fully realized.* In other words, air removal was found to be the crux of the problem of process steam distribution. Air is present in two forms. It fills the steam compartments when the machine is cold. The second form is in mixture with the steam, carried over from the source of supply. This air must be completely discharged before the apparatus can function at full efficiency. Obviously, the more quickly this discharge can be accomplished the sooner the apparatus will reach its maximum output.

The presence of air, of course, retards the transmission of heat and its existence either in air-bound pockets or in mixture with steam will reduce the output of any heating unit. The result of the presence of air is shown by the chart, Figure 1.

The second problem in obtaining free and economical circulation is the complete discharge of water of condensation. Our investigators did not find this to be so acute. Various bucket and float types of traps when properly applied will handle large volumes of condensation, but they are less effective in removing the air.

Webster engineers, therefore, concentrated their efforts on the development of methods for assuring prompt, complete and continuous discharge of both air and condensation. The apparatus developed for this purpose consists of a series of thermostatic traps—*Webster Series "78"* and *Series 7-M Traps;* and a series of combination float-and-thermostatic traps for larger volumes and hot condensate—*Webster Series "79" Traps.*

Webster Process Steam Traps have now been placed in thousands of installations where they have definitely proved all that was claimed for them—quick, continuous and complete discharge of air and water of condensation with resulting important economies and marked production increases.



Per Cent of Air in Steam Compartment

Fig. 1—Showing effect of air in steam chamber on heating efficiency of process-steam-using apparatus

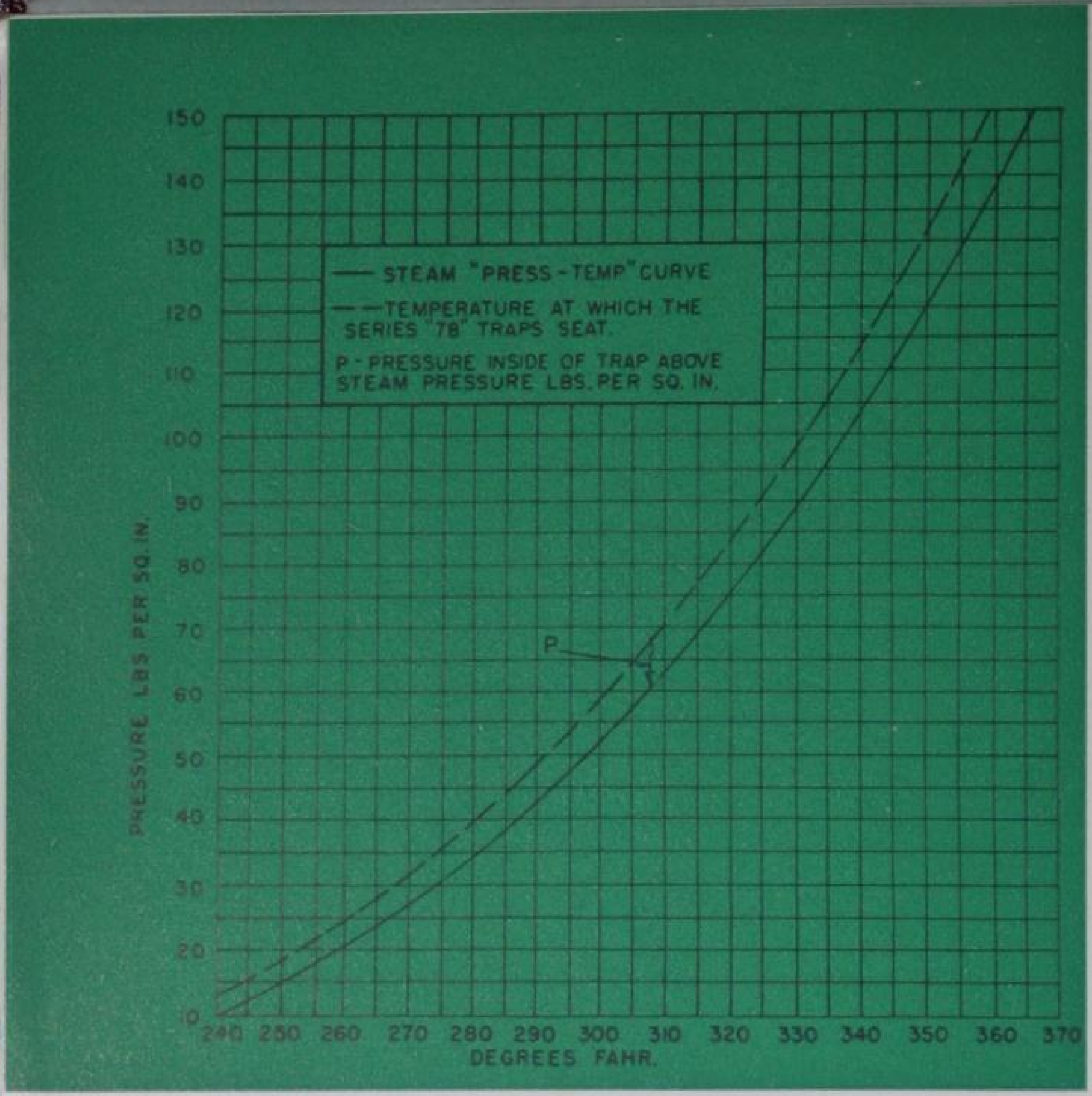


Fig. 2—Showing how Webster Series "78" Traps are fully compensated for pressures within their operating range

COMPENSATION FOR PRESSURE

Webster Thermostatic Traps of all types are fully compensated for pressure and will *function* at all pressures between the maximum obtainable vacuum and the maximum pressure. The maximum pressure stated in the table is in all cases considerably below the actual maximum at which failure to function may occur. An indication of the reserve strength is given by the test illustrated in Figure 5.

The amount of power developed by a thermostatic trap is fixed and not variable. Hence, as the pressure differential to be overcome in opening the trap increases, the seat opening must be reduced in area to permit the available drop to cause the trap to open. Hence, the only difference in traps for various pressure classifications is in the size of the seat opening.

It is also naturally true that the life of a trap or any other mechanical device subjected to steam pressures tends to decrease as the pressure to which it is normally submitted increases. It is accordingly always desirable to operate all classes of steam-using equipment at the *minimum* pressure consistent with the temperature desired.

WHAT IS MEANT BY COMPENSATION FOR PRESSURE?

A trap that is fully compensated for pressure will operate with equal success under all the various pressure conditions met. It will open to discharge water and air and close against steam regardless of whether the pressure inside the radiator or steam space is atmospheric, 1 pound, 10 pounds or 100 pounds, or sub-atmospheric with 5, 10, 15 or more inches of vacuum.

It is possible to provide a trap that will meet this requirement because of the quality of steam. There is a definite relationship between pressure and temperature of pure steam. This relationship is shown by the heavy line of Figure 2. As soon as the content of the trap is impure, i. e., contains water of condensation, air or other non-condensable gases, its temperature is lower. The diaphragm is in effect a spring with its normal "set" in the open position. It is charged in such manner that, when surrounded by dry steam at any pressure and temperature, an internal pressure is generated sufficiently in excess of the surrounding or external pressure to overcome the spring of the diaphragm and cause the valve to seat. This nice balance between the "spring" of the diaphragm plus the pressure outside the diaphragm and the pressure inside the diaphragm is shown by the second line of Figure 2. It will be noted that the temperature and pressure conditions at which the trap seats parallel the steam curve with a difference in pressure sufficient to overcome the spring tension.

RE-EVAPORATION

At times thermostatic traps are assumed to be leaking when in reality re-evaporation of the discharge is occurring. Pure steam, whether wet or dry, at atmospheric pressure has a temperature of 212 degrees F. At 50 pounds pressure above atmosphere it has a temperature of 297 degrees F. If water is discharged from an enclosure where this condition prevails into a space at atmospheric pressure the 297 degrees F. water will boil or turn to steam, and this action will continue until the temperature of the discharged water has been reduced to 212 degrees F. The action of water turning to steam in passing from a higher pressure to a lower pressure is known as re-evaporation. Its existence in a trap discharge is, in fact, reliable proof of proper trap operation.

WEBSTER SERIES "78" THERMOSTATIC TRAPS

For Working Pressures up to 150 Pounds per Square Inch

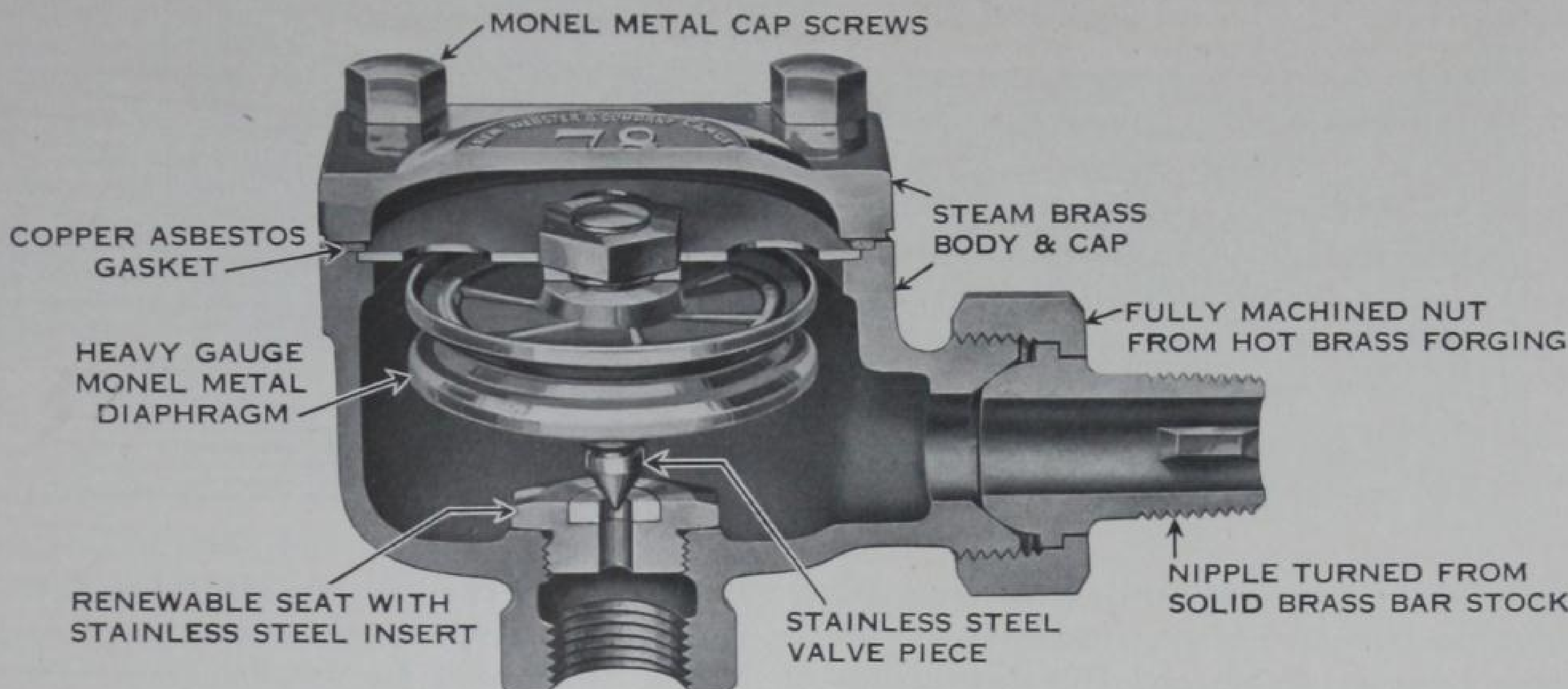


Fig. 3—Webster Series "78" Thermostatic Trap—½ inch 782 size

Webster Series "78" Thermostatic Traps, when installed as recommended on Webster Service Details, provide automatic, quick and complete discharge of air and water of condensation from process-steam-using equipment.

WILL OPERATE AT LOW PRESSURE

While intended primarily for steam pressures above 15 pounds, Webster Series "78" Traps will work equally well at low pressures, although, of course, the capacity will decrease with the pressure.

A SPECIALLY DESIGNED PROCESS STEAM TRAP

Webster Series "78" Traps have been developed *from the ground up* for operation at the stated pressures. They are not just an adaptation of a low-pressure design to high-pressure duty. That this is the case will be quickly realized by an examination of the sectional illustration in Figure 3 and description of its design and construction.

DESIGN AND CONSTRUCTION

All materials entering into the construction of Webster Series "78" Traps have been selected for their ability to withstand the severe service involved in handling steam at pressures up to 150 pounds per square inch.

The body and cover of the trap are made of steam brass. The cover is fastened to the body by Monel Metal cap screws, except sizes 780 and 781, which use a threaded cap. A copper-asbestos gasket fitting into a recess insures a tight joint.

The expansion member is made of Monel Metal, heavily ribbed. It is held securely in position in the trap body by means of a heavy gauge brass circular plate to which it is bolted and which rests in a recess turned in the body. An extra thick shoul-

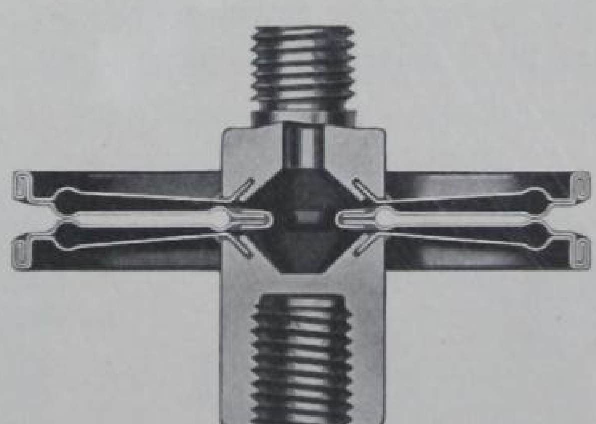


Fig. 4—Sectioned diaphragm of Series "78" Trap. Made of Monel Metal which retains its "spring" characteristics under varying conditions of temperature and pressure. Note joints which are triple-sealed: tinned, rolled and soldered with pure tin to assure tightness.

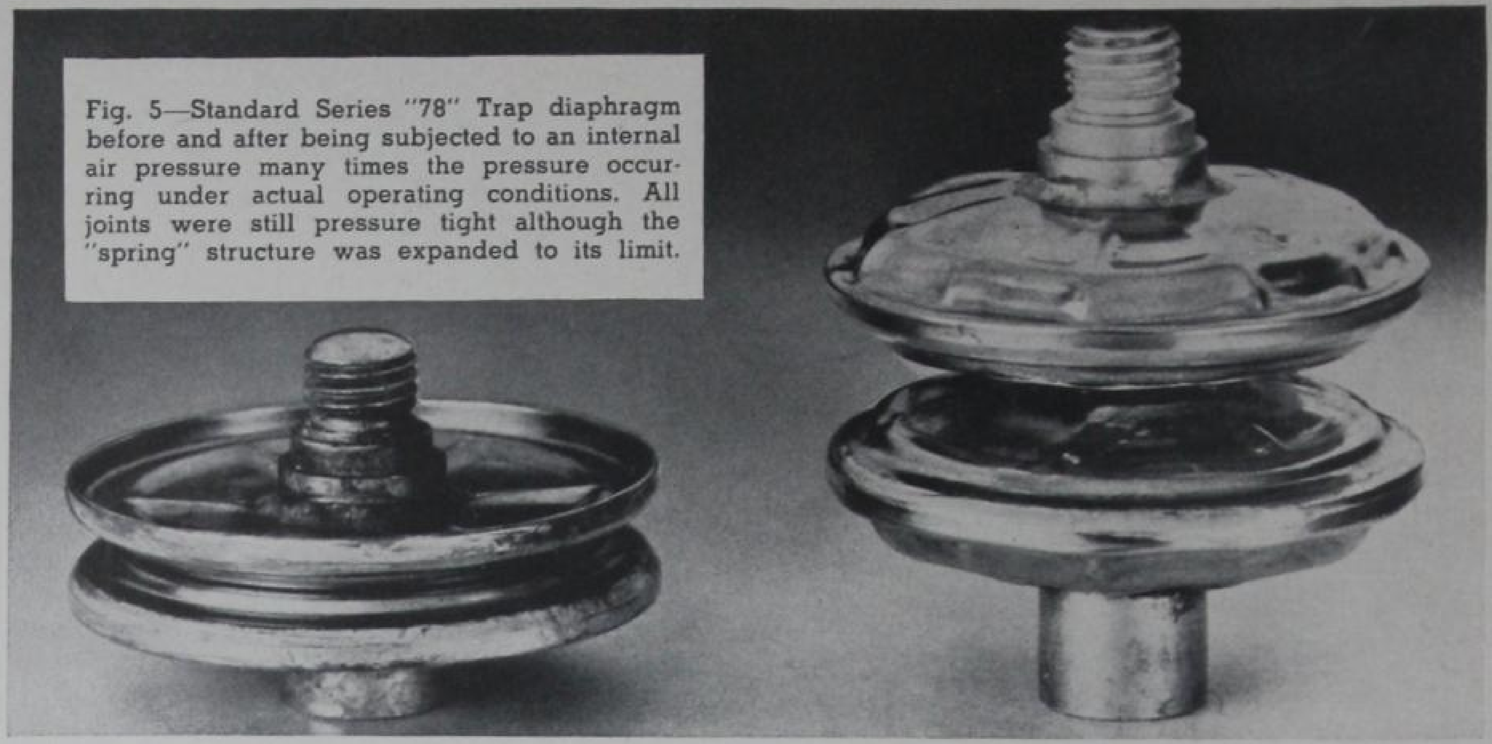


Fig. 5—Standard Series "78" Trap diaphragm before and after being subjected to an internal air pressure many times the pressure occurring under actual operating conditions. All joints were still pressure tight although the "spring" structure was expanded to its limit.

BEFORE AFTER

der keeps the upper part of the diaphragm far enough away from the plate to permit steam to entirely surround the diaphragm. This construction also allows the interior to be easily removed for blowing scale, sand, grease, etc., out of the piping when first starting up, and also for later inspection and renewal of parts.

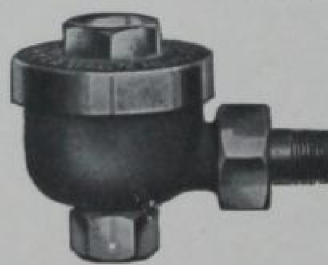
The cone-shaped valve piece closes against a sharp-edged seat. The valve piece and seat insert are made of Stainless Steel. The seat has a hexagon head and is screwed into the outlet of the trap body, permitting easy replacement.

SELECTED MATERIAL A FEATURE

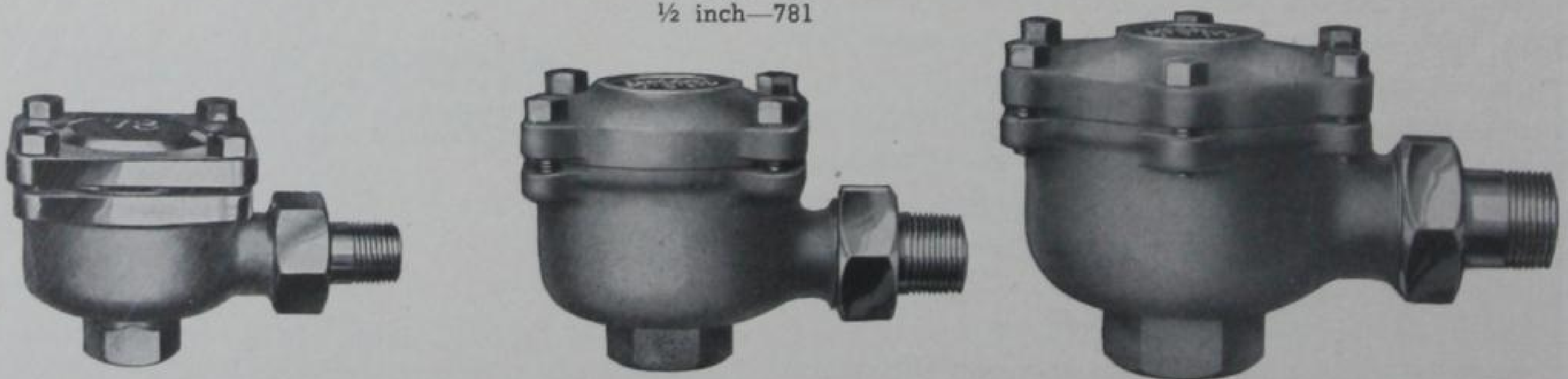
The materials selected for each part follow the best metallurgical practice. This is typical of the policy followed throughout in making Webster Series "78" Traps especially for process steam pressures. Stainless Steel selected for valve piece and insert seat is admirably adapted to withstand the severe scoring action of steam at high velocity. Monel Metal used for the diaphragm and cap screws is widely known for its strength and resistance to corrosion and erosion. Note the fully machined nut from brass forging and the nipple turned from solid brass bar stock, with broached lugs.

SIZES AND TYPES

Webster Series "78" Traps are made in the angle pattern only. Standard body has union male inlet and female outlet as shown in Figure 6. All sizes and models are made in two pressure classes. Class 2 Traps are adapted to pressures up to 60 pounds per square inch. Class 3 Traps are for pressures from 60 to 150 pounds per square inch. The only difference in these classes is in the size of the seat opening, which is made smaller for the higher pressures.



⅜ inch—780
½ inch—781



½ inch—782 ¾ inch—783 1 inch—784

Fig. 6—Webster Series "78" Thermostatic Traps

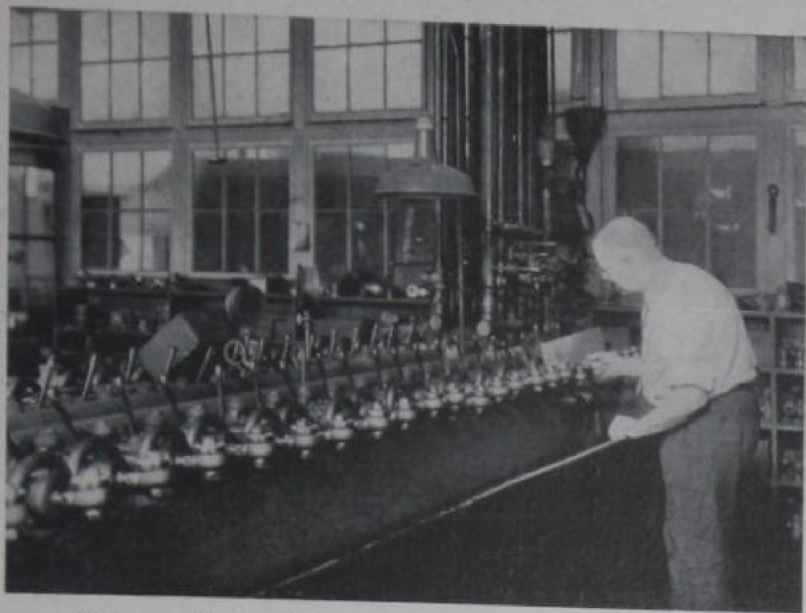


Fig. 7—Test table where each Webster Series "78" Trap is tested with both hot water and steam

INSPECTION AND TEST

Unusual care is taken throughout the manufacture of Series "78" Traps to insure uniformity and long service. After complete assembly each trap is placed on a test table and (1) tested for casting defect, i. e., leakage under pressure, (2) given steam tests at both low and maximum pressures to assure satisfactory closing, (3) given a pressure cold water test to assure satisfactory opening, and then (4) subjected to a mirror test which detects leakage around the cap joint not visible to the naked eye.

No trap is permitted to leave the factory that has not passed all tests, and proved that it will function properly.

CAPACITIES (See Page 10)

The maximum capacities of Webster Process Steam Traps given on page 10 are the result of actual tests and are based on continuous discharge.

SERIES "78" THERMOSTATIC TRAP capacities were obtained with condensate 10° F. lower than the corresponding steam temperature at the operating steam pressure. Where condensate to be handled is 5° F. lower than steam temperature, the maximum capacity can safely be taken at ¼ of the figure given in the table. It is good practice to select thermostatic traps on the basis of capacities at the lower temperature difference.

SERIES "79" FLOAT-AND-THERMOSTATIC TRAP capacities were obtained with condensate at or about steam temperature. The practice of heating engineers varies somewhat but the usual basis is to select a trap whose capacity is about twice that of the maximum indicated load requirement. This is most likely to occur when first starting up cold apparatus or when performing maximum work for which the apparatus is designed.

Pressure differences given refer to pressures at inlet of trap and in return line. Series "78" Class 2 Traps should be selected when the maximum working pressure will not exceed 60 lbs. per sq. in. and where the prevailing operating pressures will be between 15 and 60 lbs. If prevailing pressure during the greater portion of the operating time will be below 25 lbs., and more ample capacity is desired in this lower range of pressures, consideration should be given to use of Webster Series 7-M Traps.

Similarly, Class 3 Traps should be selected where maximum pressure will reach 150 lbs. per sq. in. and prevailing pressure will reach between 60 and 150 lbs.

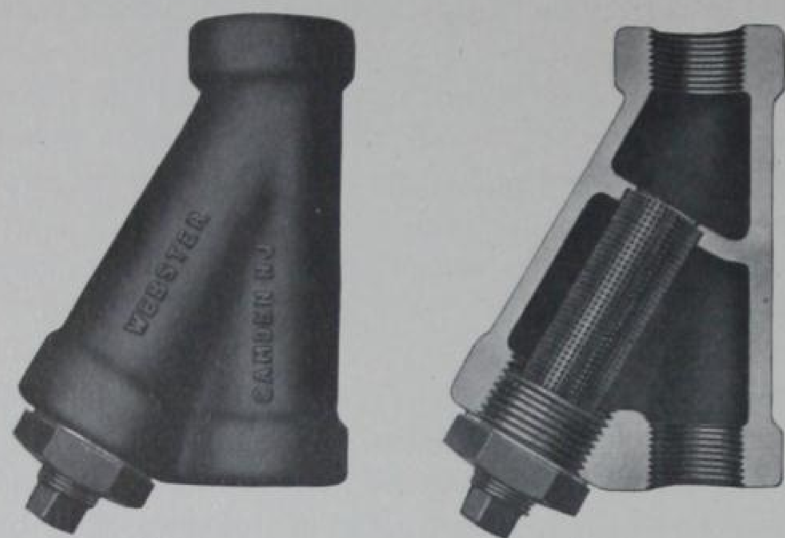
Where large volumes of very hot condensation must be handled more quickly than is possible by thermostatic traps alone, a combination float-and-thermostatic trap (Webster No. 794-T) should be used. This trap is made in five pressure classifications, the only difference being in the size of the float-controlled seat opening. Selection can be made from Table III in a manner similar to that described for Series "78" Traps.

• • •

WEBSTER SERIES "78" DIRT STRAINERS

For Working Pressures up to 150 Pounds per Square Inch

Webster Series "78" Dirt Strainers have been provided to be placed ahead of Webster Process Steam Traps located at drip points in the supply piping or attached to apparatus which is likely to contain core sand, pipe scale or sediment. Class 3 Traps in particular should thus be protected because the valve seat opening is necessarily smaller. It is better to install a Webster Series "78" Dirt Strainer in all cases and be on the safe side, than to save a few dollars and be required to purchase repair parts later.



Exterior Section
Fig. 8—Webster Series "78" Dirt Strainer

The bodies of Webster Series "78" Dirt Strainers, except Model B Strainers, are made of cast iron. The baskets are of perforated brass, having an ample free area as listed in Table I. Monel baskets can be obtained on special order at additional cost. A heavy brass plug holds the basket firmly in position. It is only necessary to unscrew this plug in order to remove the basket for cleaning.

Model B Strainers are similar to the other sizes except that they have brass bodies. They are made primarily for use with sterilizers, coffee urns, and other process-steam-using equipment when appearance and frequent cleaning are important factors.

Table I—Free Area Through Baskets of Series "78" Strainers Using Brass or Monel Screen With No. 4 Holes (Diameter .045"), 225 Holes per Sq. In.

Size	Symbol	Free Area in Square Inches	Pipe Area in Square Inches	Ratio Free Area to Pipe Area
3/8"	782-1	1.71	.191	8.9 to 1
1/2"	782-1	1.71	.304	5.6 to 1
3/4"	783-1	2.09	.533	3.9 to 1
3/4"	784-1	3.04	.533	5.6 to 1
1"	784-1	3.04	.863	3.5 to 1
1 1/4"	785-1	4.59	1.50	3.1 to 1
1 1/4"	786-1	7.89	1.50	5.1 to 1
1 1/2"	786-1	7.89	2.04	3.7 to 1
2"	788-1	11.04	3.36	3.3 to 1

Dimensions—See Table VI, page 11.
Data for Ordering—See Table X, page 12.

WEBSTER SERIES 7-M TRAPS

For Working Pressures up to 25 Pounds per Square Inch

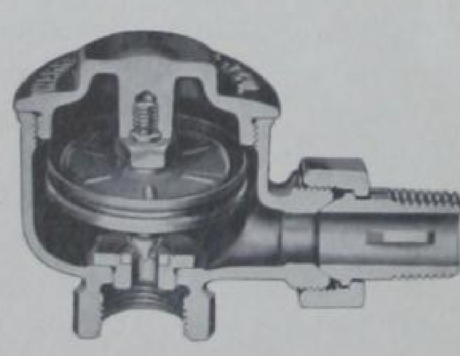


Fig. 9—Webster Size 702 Trap

If normal working pressures within the apparatus served do not exceed 25 pounds per square inch, and if more ample capacity is desired at these pressures, Webster Series 7-M Thermostatic Traps should be considered. Select trap by ratings given in Table IV on page 10. These ratings are conservative and, in general, can be used without further safety factor.

Construction—Like all Webster Thermostatic Traps, the Series 7-M is fully compensated for pressure (see page 4). The triple-sealed, liquid-filled diaphragm which is the thermostatic element is made from Monel Metal and is assembled and permanently adjusted at the factory with its Stainless Steel valve piece. The renewable sharp-edged seat is brass with Stainless Steel insert. All sizes and models use high-grade steam brass bodies. Caps are hot brass forgings. Nipples are turned from solid brass bar stock while the nut is a fully machined hot brass forging.

Application—Methods of application for the Series "78" Trap, described on page 13 and pages following, in general apply to the Series 7-M Trap. Avoid superheat by using a cooling leg which will dissipate the heat before it reaches the trap.

Rated Capacities—See Table IV, page 10.
Dimensions—See Table VIII, page 11.
Data for Ordering—See Table XII, page 12.

WEBSTER SERIES "79" TRAPS

For Working Pressures up to 150 Pounds per Square Inch

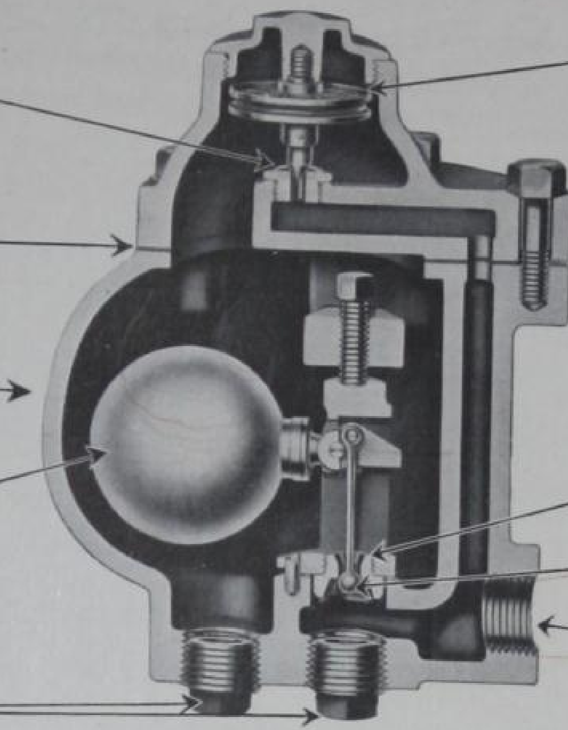


Fig. 10—Webster Series 794 Float-and-Thermostatic Trap

Where larger volumes of very hot condensate must be handled quickly, Webster Series 79 Traps should be used. These are float-and-thermostatic traps designed especially for normal working pressures between 15 and 150 pounds per square inch. Water of condensation is passed through a float-controlled seat opening while air is released into the return piping by a thermostatically controlled vent.

The Webster Series 79 Trap meets the need for a rugged, heavy duty trap yet is compact and light in weight so that it can be readily mounted right in a pipe line without other support.

Construction — As can be seen in Table III, page 10, Webster Series 79 Traps are made in five pressure classifications, the only difference being in the size of the float-controlled seat opening. Cast iron body and cover are bolted together with steel cap screws. A copper-asbestos gasket is inserted between these parts to form a tight joint. Valve piece and stem are Monel Metal while the seat is Stainless Steel. The valve bracket is held in place by a steel clamp and Monel Metal set screw.

The air vent unit is a duplicate of that used in the well-known Webster Series 780 Thermostatic Trap. Here the diaphragm is Monel Metal while the valve piece and seat insert are Stainless Steel.

Application—Webster Series 79 Traps can be used wherever process steam, i. e., up to 150 pounds per square inch is used. Superheat must be avoided by employing a cooling leg or other means to dissipate heat before it reaches the trap. The general method of installation is shown in Figure 14, page 13. Use of a Webster Series 78 Dirt Strainer is always recommended.

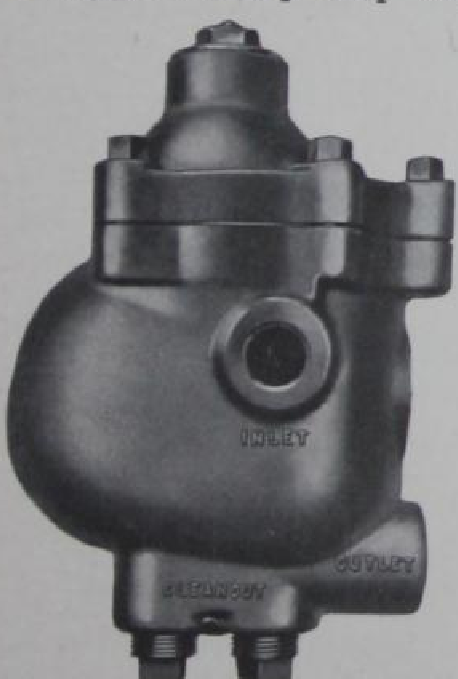


Fig. 11—Series 794 Trap and Nameplate

Capacities—See Table III, page 10.

Dimensions—See Table VII, page 11.

Data for Ordering—See Table XI, page 12.

Capacities and Ratings in Lbs. Water per Hour*

IMPORTANT: See explanation on page 7 before using tables

Capacities at Normal Working Pressures are given in **bold face** type

Table II—Webster Series "78" Traps

Capacities given are actual flooded capacities with condensate temperature 10° F. below corresponding steam temperature.

Symbol of Trap	Pressure Differential, lbs. per sq. in.											
	5	15	25	30	40	50	60	80	90	100	125	150
Class 2—Working Pressures up to 60 lbs. per sq. in.												
780-2	190	**300**	**360**	**400**	**440**	**480**	**530**	590	620	650	700	760
781-2	200	**310**	**380**	**420**	**460**	**510**	**550**	620	650	680	740	800
782-2	350	**550**	**680**	**740**	**830**	**920**	**1000**	1100	1170	1220	1350	1450
783-2	560	**880**	**1080**	**1160**	**1300**	**1430**	**1530**	1700	1790	1870	2040	2210
784-2	970	**1520**	**1870**	**2020**	**2280**	**2460**	**2680**	3020	3150	3320	3620	3860
Class 3—Working Pressures up to 150 lbs. per sq. in.												
780-3	150	250	300	320	370	400	**430**	**480**	**510**	**540**	**590**	**630**
781-3	170	270	340	360	400	440	**480**	**530**	**560**	**580**	**640**	**680**
782-3	250	400	500	540	600	660	**720**	**810**	**850**	**890**	**980**	**1060**
783-3	310	480	600	650	720	780	**850**	**950**	**1000**	**1050**	**1160**	**1250**
784-3	680	1050	1300	1400	1570	1750	**1850**	**2100**	**2200**	**2300**	**2500**	**2700**

Table III—Webster Series "79" Traps

Capacities given are flooded capacities with condensation at about steam temperature.

Symbol of Trap	Pressure Differential in lbs. per sq. in.																		
	5	10	15	20	25	30	40	50	60	70	75	80	90	100	110	120	130	140	150
Class 2A—Working Pressures 15 to 30 lbs. per sq. in.																			
794-T-2A	1260	1640	**1900**	**2140**	**2320**	**2500**													
Class 2B—Working Pressures 30 to 60 lbs. per sq. in.																			
794-T-2B	630	800	930	1040	1150	**1200**	**1340**	**1450**	**1540**										
Class 3A—Working Pressures 60 to 90 lbs. per sq. in.																			
794-T-3A	320	420	470	540	580	630	700	750	**800**	**830**	**860**	**880**	**920**						
Class 3B-1—Working Pressures 90 to 120 lbs. per sq. in.																			
794-T-3B-1	230	310	360	400	440	470	530	570	610	640	660	680	**700**	**720**	**740**	**760**			
Class 3B-2—Working Pressures 120 to 150 lbs. per sq. in.																			
794-T-3B-2	180	220	260	300	340	360	400	440	470	510	530	540	560	580	620	**640**	**660**	**680**	**700**

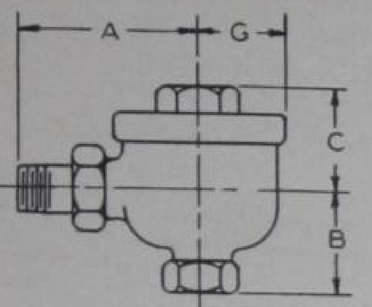
Table IV—Webster Series 7-M Traps

Figures given are conservative ratings, not full flooded capacities.

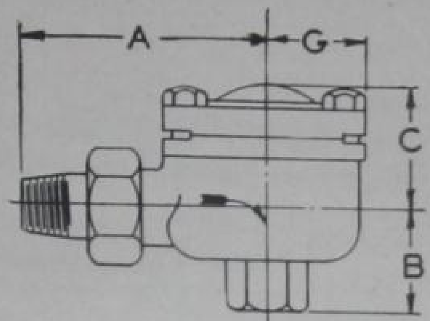
Symbol of Trap	Pressure Differential in lbs. per sq. in.						
	1	2	5	10	15	20	25
702M	**41**	**59**	**93**	**133**	**160**	**186**	**210**
713M	**83**	**116**	**183**	**263**	**319**	**369**	**410**
724M	**145**	**203**	**320**	**460**	**565**	**640**	**725**

* To convert ratings given in lbs. per hr. of water to sq. ft. e.d.r. at 240 B.T.U., multiply by 4. To convert ratings given in sq. ft. e.d.r. at 240 B.T.U. to lbs. per hr. of water, divide by 4. To convert ratings given in lbs. per hr. of water to liters per hr. multiply by 0.455. To convert ratings in sq. ft. e.d.r. to liters per hr. multiply by 0.114.

Table V—Dimensions of Webster Series "78" Traps



Sizes 780 and 781



Size 782 and larger

Symbol	Inlet	Outlet	A	B	C	G
780†	3/8	3/8	2 9/16	1 3/16	1 13/16	1 1/4
781	1/2	1/2	2 3/4	1 5/16	1 13/16	1 1/4
782*	1/2	1/2	3 9/16	1 7/16	1 15/16	1 5/8
783	3/4	3/4	3 13/16	1 7/16	2 3/8	1 13/16
784	1	1	4 1/2	2	2 7/16	2 3/8

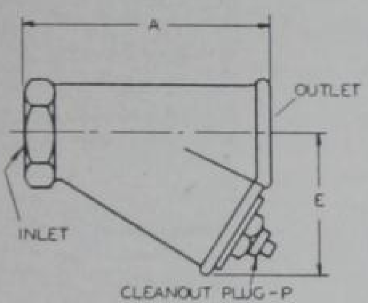
All dimensions in inches and subject to slight variation.

† 780 Trap furnished with 3/8-inch female nipple on special order. Dimension A = 2 3/4 inches.

* 782 Trap furnished on special order with 3/8-inch male nipple, also 3/8-inch or 1/4-inch female nipple to fit standard 1/2-inch union nut. Dimension A = 3 3/8 inches.

Table VI—Dimensions of Webster Series "78" Strainers

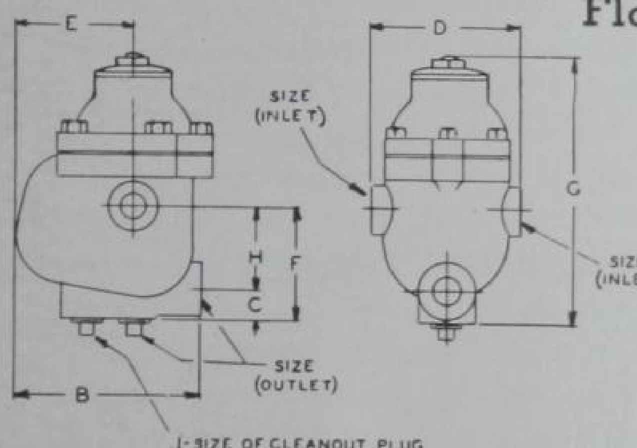
NOTE—Listed here in 3/8-inch to 2-inch sizes only. Also available in cast iron only in sizes 2 1/2, 3, 4, 5 and 6 inches with flanged connections, standard weight, for 125 lbs. sq. in. service. Dimensions and complete information on request.



Symbol		All Models			Cast Iron Body		Brass Body	
Cast Iron	Brass	Inlet	Outlet	Plug-P	A	E	A	E
782-1	782B-1	3/8	3/8	3/8	3 3/4	2 1/4	3 3/4	2 1/4
782-1	782B-1	1/2	1/2	3/8	3 3/4	2 1/4	3 3/4	2 1/4
783-1	......	3/4	3/4	3/8	4 1/8	2 1/4	Not	Made
784-1	784B-1	3/4	3/4	1/2	4 5/8	3 1/8	4 5/8	3 1/8
784-1	784B-1	1	1	1/2	4 5/8	3 1/8	4 5/8	3 1/8
785-1	......	1 1/4	1 1/4	1/2	5 1/2	3 1/2	Not	Made
786-1	786B-1	1 1/4	1 1/4	3/4	6 1/4	4	6	4
786-1	786B-1	1 1/2	1 1/2	3/4	6 1/4	4	6	4
788-1	788B-1	2	2	3/4	7 1/8	4 3/4	7	4 5/8

When ordering state both symbol and size.
All dimensions in inches and subject to slight variation.
B Models have cast brass body. Standard models have painted, cast-iron bodies.

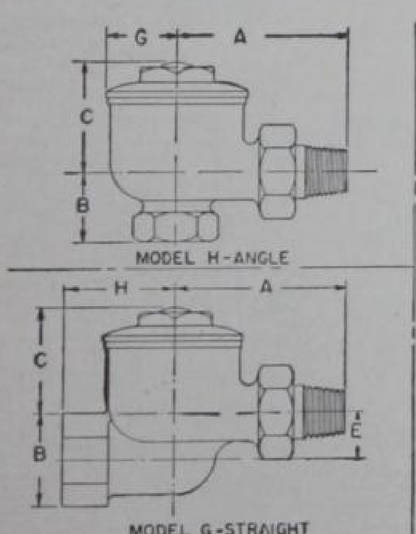
Table VII—Dimensions of Webster Series "79" Traps Float-and-Thermostatic Type

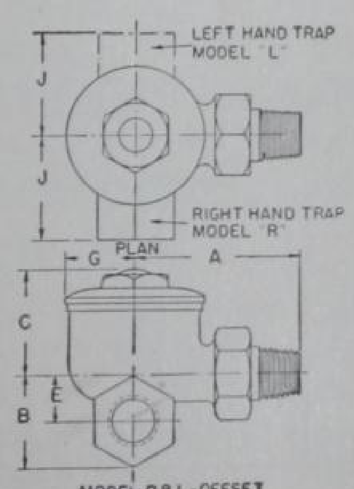


Symbol	Size	B	C	D	E	F	G	H	J
794-T	1	6 3/8	1 1/8	4 1/2	3 15/16	3 15/16	8 7/8	2 13/16	1

All dimensions in inches and subject to slight variation.

Table VIII—Dimensions of Webster Series 7-M Traps





Symbol	Model	Size	A	B	C	E	G	H	J
702M	H	1/2	2 3/4	1 1/8	1 13/16		1 3/16		
	G		2 3/4	1 1/2	1 13/16	3/4	1 3/16	1 13/16	
	R & L		2 3/4	1 1/2	1 13/16	3/4	1 3/16		1 5/8
713M	H	3/4	3 9/16	1 7/16	1 11/16		1 5/8		
	G		3 9/16	1 11/16	1 11/16	3/4	1 5/8	2 1/4	
724M	H	1	4 1/4	1 13/16	2 3/16		1 7/8		

All dimensions in inches and subject to slight variation.

Table IX—Data for Ordering Webster Series "78" Traps

Size, Inches	Pressure Range, Lbs.	Symbol	Net Weight, Lbs.	Code Word
3/8	25- 60	780-2†	1½	Sevmag
3/8	60-150	780-3†	1½	Sevmagry
½	25- 60	781-2	1¾	Sevmek
½	60-150	781-3	1¾	Sevmekry
½	25- 60	782-2*	3	Sevmut
½	60-150	782-3*	3	Sevmutry
¾	25- 60	783-2	4¼	Sevnip
¾	60-150	783-3	4¼	Sevnipry
1	25- 60	784-2	7	Sevpeg
1	60-150	784-3	7	Sevpegry

† 780 Trap furnished with 3/8" female nipple on special order.
* 782 Trap furnished on special order with 3/8" male nipple also 3/8" or ¼" female nipple to fit standard ½" union nut.

Table X—Data for Ordering Webster Series "78" Strainers

Size, Inches	Maximum Pressure, Lbs.	Symbol	Net Weight, Lbs.	Code Word
3/8	150	782-1	1 3/8	Sevra
½	150	782-1	1 3/8	Sevrabt
¾	150	783-1	1½	Sevrads
¾	150	784-1	2 5/8	Sevrack
1	150	784-1	2 5/8	Sevrage
1¼	150	785-1	4¼	Sevrehn
1¼	150	786-1	6¼	Sevrek
1½	150	786-1	6¼	Sevrelt
2	150	788-1	9	Sevremp
3/8	150	782B-1	1 3/8	Sevren
½	150	782B-1	1 3/8	Sevrip
¾	150	784B-1	2 7/8	Sevrisk
1	150	784B-1	2 7/8	Sevrose
1¼	150	786B-1	6	Sevroty
1½	150	786B-1	6	Sevrow
2	150	788B-1	8	Sevrux

Symbol B models have brass body. Other models with cast iron painted body.
IMPORTANT: When ordering give both size and symbol.

Table XI—Data for Ordering Webster Series "79" Traps

Size, Inches	Pressure Range, Lbs.	Symbol	Net Weight, Lbs.	Code Word
1	15- 30	794-T-2A	12½	Nintosk
1	30- 60	794-T-2B	12½	Nintowt
1	60- 90	794-T-3A	12½	Nintunt
1	90-120	794-T-3B1	12½	Nintuve
1	120-150	794-T-3B2	12½	Nintux

Table XII—Data for Ordering Webster Series 7-M Traps

Operating Pressure Range up to 25 lbs. per sq. in.

Size, Inches	Symbol	Body Model	Net Weight, Lbs.	Code Word
½	702M-H	Angle	1¼	Sevbanem
½	702M-G	Straight	1 3/8	Sevbanemog
½	702M-R	Right Offset	1 3/8	Sevbanemar
½	702M-L	Left Offset	1 3/8	Sevbanemel
¾	713M-H	Angle	2¾	Sevcupem
¾	713M-G	Straight	3	Sevcupemog
1	724M-H	Angle	3¾	Sevgivem

METHODS OF APPLICATION

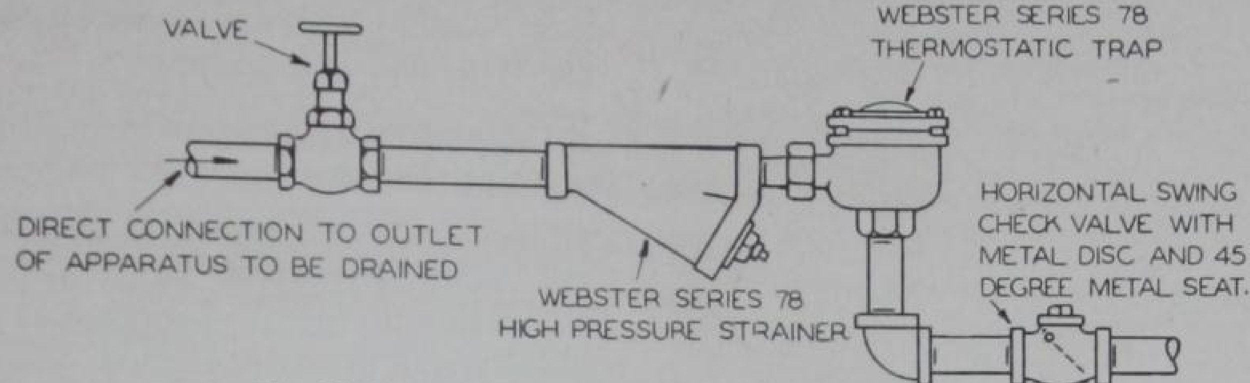


Fig. 12—General Method of Application, Series "78" Trap

GENERAL APPLICATION

Webster Process Steam Traps are usually applied so as to remove both the condensation and air (or other non-condensible gases) from the steam chamber of the apparatus or surface heated to the condensation return system, usually for return to the boiler. At other times they may be used solely to assure prompt and effective venting of the heated space, i. e., sterilizing chamber, cooking compartment, etc.

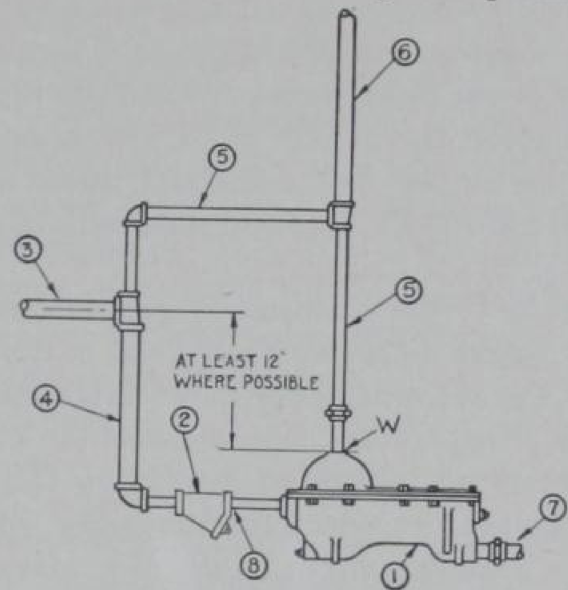
REMOVAL OF CONDENSATION AND AIR

Webster Process Steam Traps are connected to the outlet of the apparatus to be drained (see Figures 12 and 14).

Note that a horizontal swing check valve is placed in the discharge pipe from the trap. The valve should be of first-class make and of the type having a seat at an inclination of 45 degrees and with the disc made of metal. A check valve with composition disc should never be installed, as there is always a likelihood of the disc curling up after a period of use, causing the valve to leak.

The discharge pipe should be vented to the atmosphere so as to permit the rapid escape of air which has been passed by the trap. A very effective arrangement, is to connect the discharge pipes from the various traps of the installation into a common return which is run to a vented receiver.

The traps should never discharge directly into a vacuum return main, as the high temperature con-



1 = Webster Heavy Duty Trap Series 26-0.
2 = Webster Dirt Strainer Series 78.
3 = Return from High Pressure Traps.
4 = At least 2" Pipe.
5 = Same Size as Outlet W.
6 = Vent to heat Main or to Atmosphere. 2 Pipe Sizes Larger than Outlet W.
7 = Connection to Main Vacuum Return.
8 = Same Size as Inlet to Trap.

Fig. 13—Method of Draining Condensation from Webster High-Pressure Traps, into Vacuum Return Through Webster Heavy Duty Trap

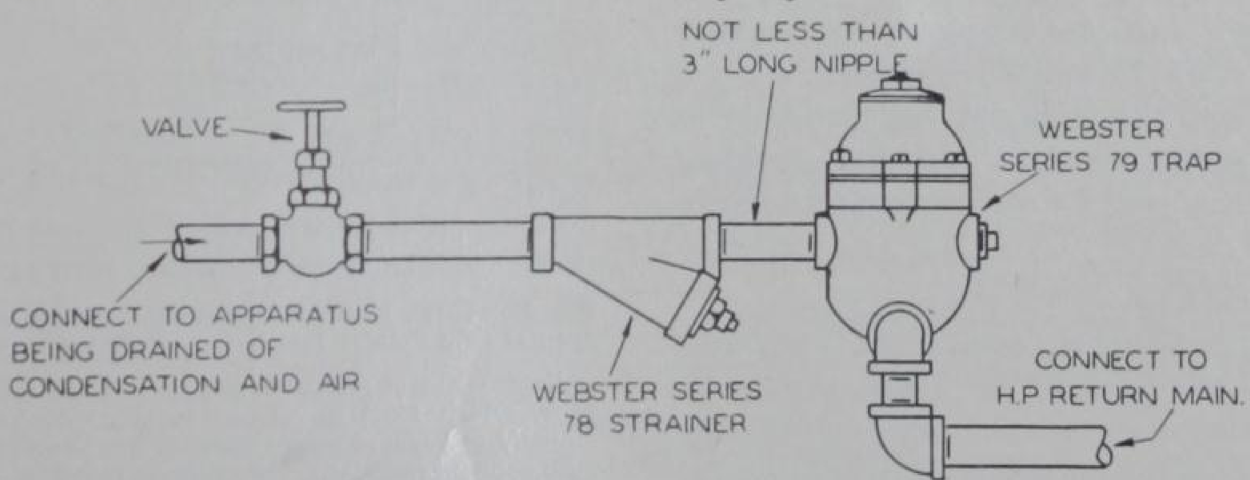


Fig. 14—General Method of Application, Series "79" Trap

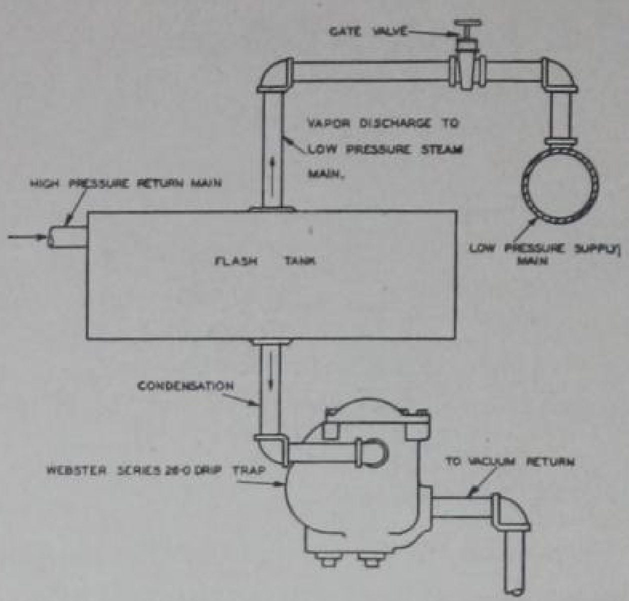


Fig. 15—Method of Connecting Discharge from Webster Series "78" Traps to Vacuum Return Through Flash Tank and Webster Series 26 Trap

densate will re-evaporate upon entering the region of lower pressure and the vapor thus formed may seriously lower the vacuum and require the use of jet water at the pump. One protective measure permitting discharges into a vacuum return main is shown in Figure 13. Another method is shown in Figure 15.

In Figure 13 the condensate passes through a Webster Series 26 Heavy Duty Trap of the proper size into the vacuum return main. From the top of the vertical separating pipe marked (4) and from the outlet W on the top of the Heavy Duty Trap, vent pipes are run and joined together, discharging into a heating main or outboard to atmosphere.

VENTING

The second general type of application is to vent or assure the prompt, continuous and complete removal of air from the chamber heated in those cases where condensate is otherwise disposed of or where it is not desirable to return the condensation to the receiver.

Frequently two traps are required, one serving for removal of both air and condensation from a jacketed space and the other serving primarily to vent the air from the chamber, such little condensate as may be involved being discharged directly to a drain.

AVOID SUPERHEAT

The use of superheated steam in apparatus served by Webster Series "78" Traps should be avoided except where the construction of the apparatus is such that the superheat is dissipated before it reaches the trap. Where superheated steam cannot be avoided and there is possibility of it entering the trap, some provision such as a suitable "cooling leg" should be employed between the apparatus and the trap.

A SEPARATE TRAP ON EACH UNIT

Since the development of the Webster Series "78" Thermostatic Trap, hundreds of concerns using steam on process operations have done away entirely with the old-fashioned "master" traps and are using a separate "78" Trap on each steam-using unit. This is now accepted engineering practice.

When the condensation to be handled is very hot or exceeds the rated capacity of a single Series "78" Trap, a Webster Series "79" (combination

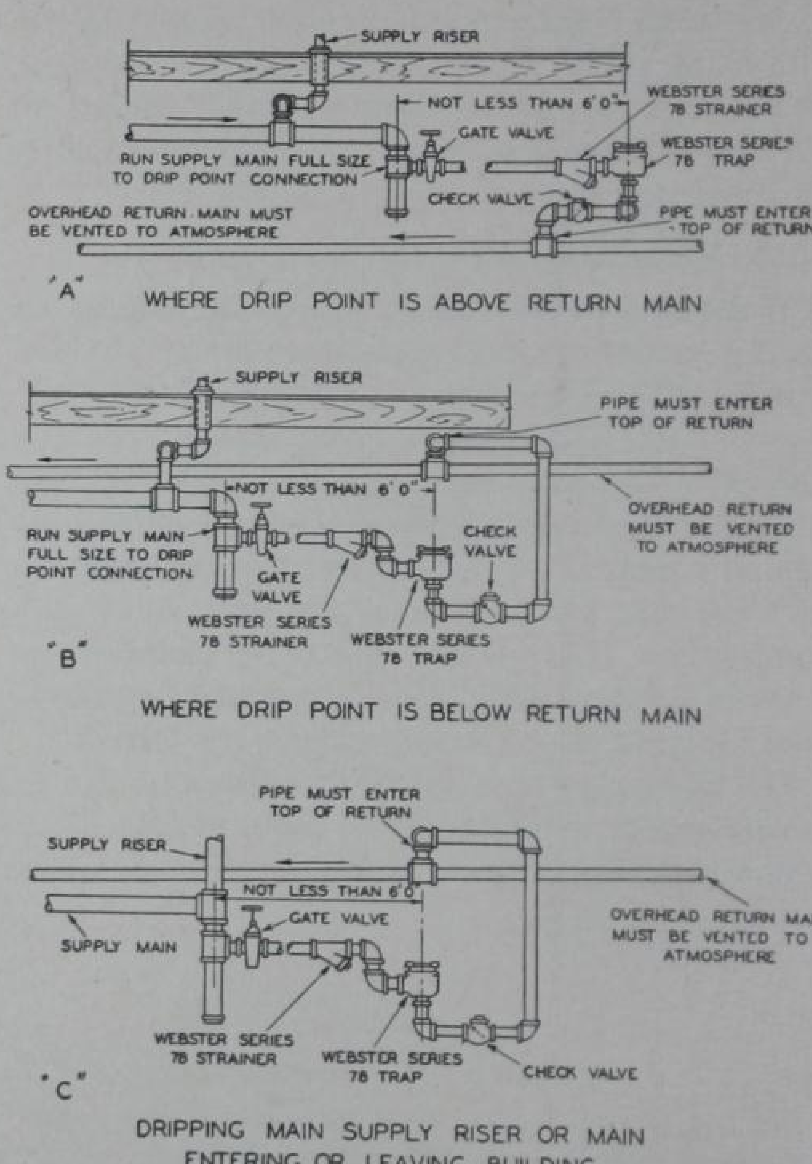


Fig. 16—Three Methods of Installation of Webster Series "78" Trap at Drip Points. Installation of Series "79" Traps is similar.

Note: Connect return from trap to high pressure drip return pipe, which must be vented to atmosphere. Do not connect *directly* to vacuum return main as introduction of high temperature condensation will cause a lowering of vacuum. If necessary to discharge condensation into vacuum return line follow special Webster service details showing protective measures necessary.

float-and-thermostatic) Trap can be used, or two or three Series "78" Traps can be connected in parallel and arranged to discharge into a common return pipe.

BLOWING OUT SYSTEM

Before putting the apparatus into use, it may be desirable to remove the expansion members from the traps and blow out the entire high-pressure piping system thoroughly to remove all scale, core sand, etc. Where a Series "78" Strainer is placed ahead of each trap, this preliminary blowing out will be less necessary, although it may be advisable.

CONNECTION AT DRIP POINTS

Three methods of applying Webster Series "78" Traps at drip points are shown in Figure 16. Detail (A) applies where the drip point is located above the return main and the flow of condensate is downward by gravity through the trap and into the return. Details B and C are to be followed when the return main is above the drip point and the condensate has to be raised. The vertical distance through which it is possible to lift the water will depend upon the differential pressure existing between the minimum steam pressure in the supply main and the maximum back pressure which may be built up in the return main.

It is preferable to locate the trap at the top of the vertical lift pipe if there is sufficient space between the overhead return and the ceiling to permit installation of trap, check valve and strainer and connection of discharge pipe into top of return pipe.

The trap should not be attached directly to the drip point. A horizontal pipe at least 6 feet long should be provided in every case, to serve as a reservoir for the sudden floods of condensation which will occur whenever steam is turned on a cold piping system.

SIZING OF TRAPS FOR DRIP CONNECTIONS

No exact method can be given for selecting the proper sizes of traps for dripping mains and risers. They must be adequate to handle the condensation at starting up periods when the steam pressure in the supply main is naturally lower than after the system is heated up.

UNIT HEATERS

Figure 17 shows a method of connecting up a single unit heater using steam at pressures between

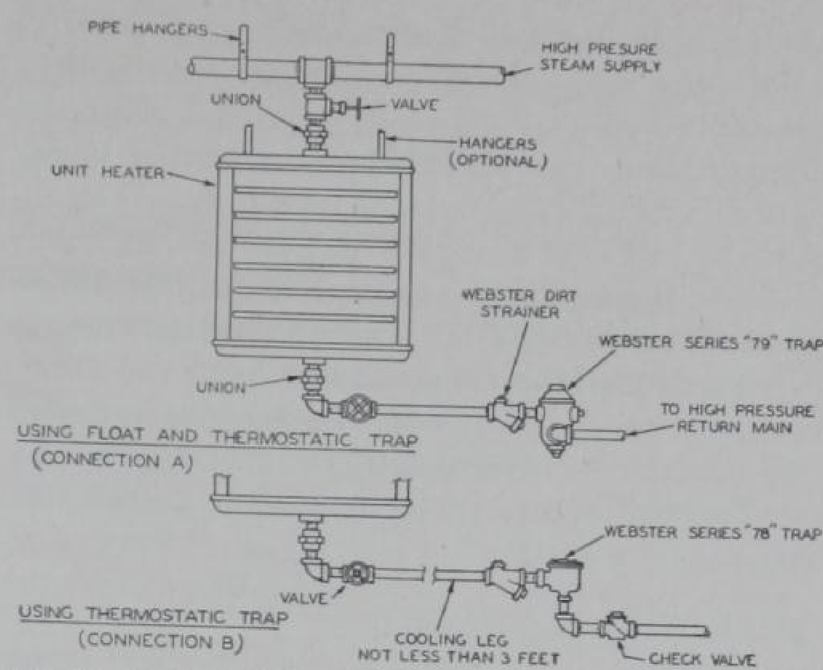


Fig. 17—Method of Dripping Unit Heater Through a Webster Dirt Strainer and Webster High-Pressure Trap—Series "78" and Series "79"

15 and 150 pounds per square inch. The discharge is connected direct to high-pressure return main, which may be above if trap discharge pressure exceeds static head in discharge pipe plus pressure (if any) in return main. Figure 18 shows method of dripping a blower-type heater using Webster Series "79" and "78" Traps. Under 15 pounds pressure, Webster Low-Pressure Traps are recommended.

SIZING TRAPS ON UNIT HEATERS

In selecting the proper size of Process Steam Trap for the unit and also for the drip, the engineer

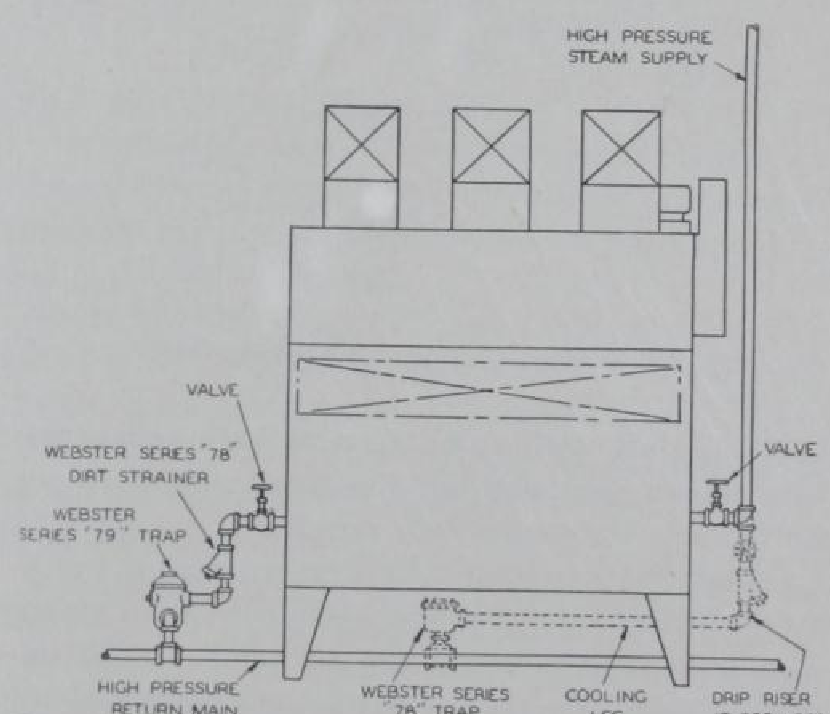


Fig. 18—Method of Dripping Blower-Type Heater Through a Webster Dirt Strainer and Webster High-Pressure Trap Series "79"

should bear in mind that the steam pressure at times, especially when starting up with a cold system, may be considerably lower than the operating pressure, as specified or as carried under normal conditions. For this reason it is recommended to select a trap having the proper rating at a low differential of say 10 or 15 pounds. When sized on such a basis, the trap will be large enough to quickly pass the condensation under the severest conditions. It is recommended that a Series "79" Combination Float-and-Thermostatic Trap be used except for small units where the Series "78" Trap may be used.

STERILIZING EQUIPMENT

Requirements for Sterilizing—Authorities agree that live steam at 250 degrees F., thoroughly penetrating for five minutes, will sterilize completely.

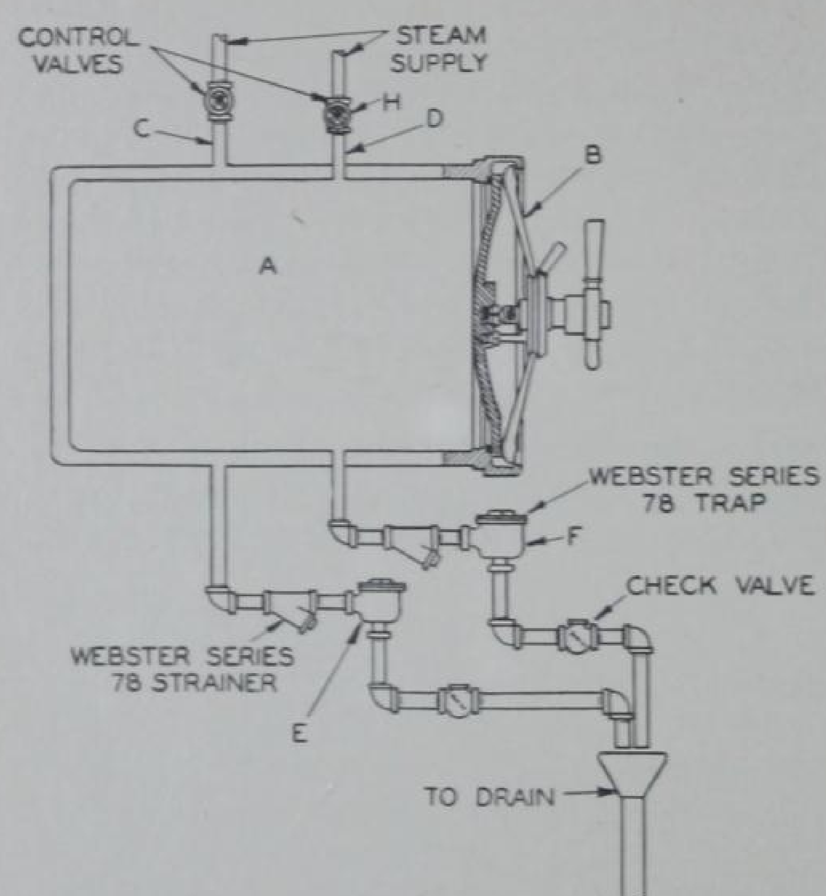


Fig. 19—Sectional Elevation of Dressing Sterilizer

While perfect sterilization may be done with somewhat lower temperature, the time necessary for sterilization increases very rapidly.

Owing to its penetrating properties, the sterilization temperature by direct contact of the steam with the material is usually accepted as 250 degrees F., and the maximum temperature as about 260 degrees F. These temperatures call for steam, unmixed with air, at pressures ranging from 15 to 20 pounds. If air is mixed with the steam, the temperature at the same pressure will be lower, depending upon the amount of air present. The presence of air in steam, therefore, reduces the sterilizing properties. To ensure complete penetration with a reasonable factor of safety, from thirty to fifty minutes should be allowed for the sterilization period, or if more pressure is available 35 to 60 pounds will speed up the operation.

TYPES OF STERILIZING EQUIPMENT

The most widely used types of sterilizing and similar hospital equipment are the following:

Dressing Sterilizers.	Milk Pasteurizers.
Water Sterilizers.	Bed Pan Sterilizers.
Instrument and Utensil Sterilizers.	Blanket Warmers.

These are described briefly. Following the description is a full discussion of the application of Webster Series "78" Traps to this class of apparatus.

DRESSING STERILIZERS

Dressings, towels and gloves are sterilized by direct contact with steam in a Dressing Sterilizer. One form of this apparatus is shown in Figure 19. It consists of a sterilizing chamber (A) surrounded by a large shell and forming a steam jacket outside the chamber. Access to the chamber is through a tight-closing door (B).

After placing the material in the chamber and closing the door, steam is admitted by hand-control valves or automatic valves through pipe (C) to the steam jacket and through (D) to the chamber at 35 to 60 pounds pressure. Both air and condensate are discharged through Webster Traps "E" and "F" to the drain which is open to the atmosphere. After sterilization has been carried on for the proper time, which varies with the form and kind of material, the steam supply valve "H" is closed. The trap "F" continues to function to discharge any air or condensation still remaining in the chamber. As the pressure in the chamber is reduced, the moisture in the dressings, or other material, resulting from sterilization by steam, will vaporize due to the continued heating of the jacket. This vapor will pass out through the Webster Trap as fast as it forms. In large sterilizers from two to five minutes will be required to dry dressings sufficiently for immediate use and storage. Trap "E" will operate continuously, removing air and discharging condensation as formed. If desired, the discharge from Trap "E" could be returned to the

condensate return system since in no case would it be contaminated by mixture with anything in the sterilizing chamber. If so returned, the return piping would embody the arrangements of Figs. 13 or 15.

WATER STERILIZERS

Perfect sterilization of the water used in surgery is absolutely necessary to secure protection against surgical infection. The water must be heated to a high temperature, that is, under pressure. It is not safe practice to simply boil the water.

Authorities state that all forms of bacteria will be destroyed in filtered water maintained at a temperature of 250 degrees for 20 minutes, and that such water is satisfactory for all surgical work, except for making solutions, in which case the water must be distilled.

Water sterilizers are invariably furnished in pairs, one for hot and one for cold sterile water, of a capacity for one maximum day's requirements only. The use of this apparatus insures continuous safety in handling the water from the time of actual sterilization to a final drawing off for use. The sterilizer tanks range in capacity from 6 to 50 gallons each. Except in very large institutions water stills are not larger than 3-gallon capacity.

A spiral-shaped coil of annealed copper tube is provided for each sterilizer tank, having inlet and outlet in the base of the tank. It contains a sufficient amount of surface to raise the water to the sterilizing temperature of 250 degrees in from 10 to 20 minutes, depending upon the capacity of the tank.

The coil in the cold tank is so valved that it may be used for either heating or cooling. Attached to the tanks are a water gauge, a thermometer, and a safety valve.

The water for the sterilizer is first filtered by being passed through a porous stone. All sediment held in suspension in the water collects on the outside of the stone, which may be taken out and cleaned.

The water still which usually accompanies a pair of sterilizer tanks makes use of the steam generated in the hot water tank during the sterilizing process. The still has a cooling coil against which the steam condenses. A considerable amount of distilled water may be made every time the tank is sterilized with no additional heat supplied. If more distilled water is needed the heat is left on the hot sterile tank until sufficient steam has been generated and condensed. *As the still itself contains no heating element, no trap is required for this piece of apparatus.*

INSTRUMENT AND UTENSIL STERILIZERS

Instruments and utensils may be sterilized by boiling or in steam under pressure. Boiling is generally accepted as the correct method.

The instrument sterilizer consists of a tank with hinged cover and provided with a tray upon which the articles to be sterilized are placed. In the instrument sterilizer the cover and tray are raised and lowered by a lifting device operated by a pedal.

The utensil sterilizer is required to handle heavier and larger material and the tank is therefore larger and the tray-lifting mechanism is more rugged.

The heating element in each type of sterilizer usually consists of a pipe coil placed in the bottom of the tank and containing sufficient heating surface to raise the water to a boiling point in a very short time. At the back of the tank near the top, a vent opening is provided for venting the sterilizer. Proper connection of this vent opening to the outside of the building will carry away most of the steam which otherwise would escape into the room. The tanks are made in several sizes, depending upon the number and size of equipment to be sterilized. The steam supply and return outlets of the coil are located on the underside of the tank.

MILK PASTEURIZERS

Pasteurization of milk calls for quick heating to pasteurization temperature, maintaining this temperature for a definite period and then quickly cooling to 50 degrees F.

Pasteurization temperatures range from 145 degrees to 180 degrees, and the time for maintaining these temperatures varies with different authorities.

Quick cooling is provided by the circulation of water through the tank and out through the overflow tank.

The general construction of the pasteurizer is similar to the instrument sterilizer. It consists of a tank with cover having a foot pedal for raising and lowering. The water is heated by a pipe coil placed on the bottom of the tank or cast in the base if the latter is made in the form of a casting.

Table XIII—Weight of Steam Required to Raise a Given Weight of Water from 70 degrees to 212 degrees F.

Steam Pressure Pounds	Temperature Deg. Fah.	Latent Heat B.t.u. per Pound	Weight of Water in Pounds												
			50	60	70	80	90	100	125	150	200	250	300	400	500
			Weight of Steam Required in Pounds												
10	239.4	952.5	7.35	8.82	10.29	11.76	13.23	14.7	18.38	22.05	29.4	36.75	44.1	58.8	73.5
15	249.0	945.5	7.5	9.0	10.5	12.0	13.5	15.0	18.75	22.5	30.0	37.5	45.0	60.0	75.0
20	258.8	939.3	7.56	9.07	10.58	12.09	13.6	15.12	18.9	22.68	30.24	37.8	45.36	60.48	75.6
25	266.8	933.7	7.6	9.12	10.64	12.16	13.68	15.2	19.0	22.8	30.4	38.0	45.6	60.8	76.0
30	274.1	928.5	7.65	9.18	10.71	12.24	13.77	15.3	19.13	22.95	30.6	38.25	45.9	61.2	76.5
40	286.7	919.3	7.72	9.27	10.82	12.37	13.92	15.44	19.3	23.16	30.88	38.6	46.32	61.75	77.2
50	297.7	911.2	7.8	9.36	10.92	12.48	14.04	15.6	19.5	23.4	31.2	39.0	46.8	62.4	78.0
60	307.3	903.9	7.85	9.42	10.99	12.56	14.13	15.7	19.63	23.55	31.4	39.25	47.1	62.8	78.5
70	316.0	897.3	7.91	9.49	11.07	12.65	14.23	15.82	19.78	23.73	31.64	39.55	47.46	63.28	79.1
80	323.9	891.1	7.97	9.56	11.15	12.74	14.33	15.94	19.93	23.91	31.88	39.85	47.82	63.76	79.7
90	331.2	885.4	8.02	9.62	11.22	12.82	14.42	16.04	20.05	24.06	32.08	40.1	48.12	64.16	80.2
100	337.9	880.0	8.07	9.68	11.29	12.90	14.51	16.14	20.18	24.21	32.28	40.36	48.42	64.56	80.7

Footnote to table—For initial water temperatures other than 70 degrees multiply the values given in the above table by the following factors.

Initial Temperature	Factor	Initial Temperature	Factor
40 deg.	1.21	60 deg.	1.07
50 deg.	1.14	80 deg.	.93

An example of the calculation called for at the left follows: The weight of steam required to heat 300 pounds of water from 70 degrees to 212 degrees with steam at 60 pounds pressure is 47.1 pounds. If the initial temperature is 50 degrees, the steam required is $47.1 \times 1.14 = 53.7$ pounds.

The supply and return outlets are located in the same relative position as the instrument and utensil sterilizers.

Note: The various pieces of sterilizing equipment described on pages 16 and 17 are mounted upon welded pipe stands. They are frequently installed singly, but more often in batteries, the number, type and arrangement depending upon the use to which they are put.

BED PAN STERILIZERS

The bed pan sterilizer consists of a hopper, having tight-fitting cover, into which live steam is admitted. There is no heating element and therefore no thermostatic trap is required.

BLANKET WARMERS

Blanket warmers frequently form part of the equipment furnished by manufacturers of sterilizer apparatus. The warmer consists of a metal cabinet with hinged door, and containing a series of perforated shelves. There is a continuous steam coil extending under each shelf. The bottom of the cabinet is raised about 6 inches above the floor to provide room for the supply and return connections of the coil. In the newer hospitals a recess or niche is provided to receive the cabinet.

One standard make of blanket warmer is 24 inches wide, 24 inches deep, 72 inches high, has five shelves and contains a steam coil having 25 lineal feet of ½-inch pipe. The steam supply and return connections are each ½ inch.

TABLE XIV—Steam Requirements of Sterilizers

Pasteurizer or Bottle Sterilizer

For pasteurization, assume 7″ of water at 70° F. heated to and maintained at 150° F. for 30 minutes. For bottle sterilization, assume 3″ of water at 70° F. heated to boiling and maintained for 20 minutes. Steam consumption in either case will be about the same, as follows:

Size Sterilizer	Steam Heat at 40 Pounds Pressure
	Pounds of Steam for One Performance
36-bottle capacity	12
54-bottle capacity	17
72-bottle capacity	23

Non-Pressure Instrument and Utensil Sterilizers

Starting with water of depth indicated, at 70° F. and maintenance of vigorous boiling for 20 minutes.

Size Sterilizer	Depth	Steam Heat at 40 Pounds Pressure
		Pounds of Steam for One Performance
8″ x 9″ x 18″	3½″	9
9″ x 10″ x 20″	3½″	10
10″ x 12″ x 22″	4″	13
12″ x 16″ x 24″	4″	20
10″ x 12″ x 36″	4″	22
16″ x 15″ x 20″	10″	31
20″ x 20″ x 24″	10″	48

Pressure Steam Sterilizers for Surgical Supplies

Sterilizing Period—30 minutes at 240°-250° F.

Size Sterilizer	Steam Heat at 40 Pounds Pressure
	Pounds of Steam for One Performance
12″ x 20″	11
14″ x 22″	14
16″ x 24″	19
16″ x 36″	27
20″ x 28″	30
20″ x 36″	39
20″ x 48″	49
20″ x 60″	62

Pressure Instrument Sterilizer

Sterilizing Period—10 minutes at 240°-250° F.

12″ x 20″	8
14″ x 22″	10
16″ x 24″	12

Pressure Laboratory Sterilizer (Autoclave)

Sterilizing Period—30 minutes at 240°-250° F.

15½″ x 24″	12
17½″ x 26″	16
21½″ x 30″	20

Water Sterilizers—One Reservoir Only

Starting with water at 70° F. and maintaining temperature—240°-250° F. for 15 minutes.

6 gallons	19
10 gallons	30
15 gallons	45
25 gallons	75
50 gallons	150

The blanket warmer is sometimes furnished in combination with a solution warmer or bed pan warmer, but the piping details are not changed.

STEAM REQUIREMENTS OF STERILIZERS

We have compiled Table XIV typical sizes of sterilizers showing the pounds of steam required to complete one performance. In all cases the initial water temperature has been assumed as 70 degrees F. and the steam pressure is 40 pounds. The compartment or tank of the sterilizers is assumed to contain water of depth shown in tables (for water sterilizers it is assumed to be full of water). The final water temperature is 250 degrees for sterilizers except when noted otherwise.

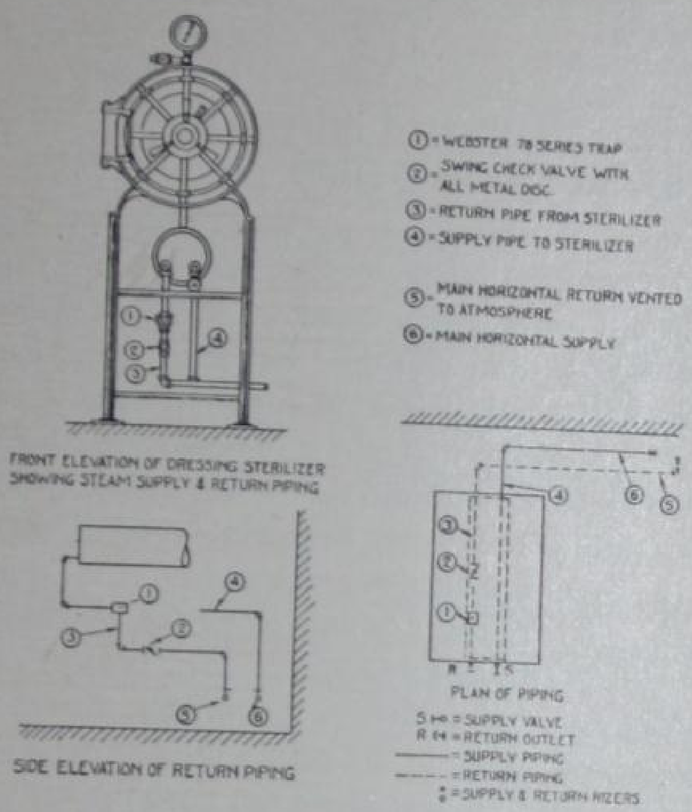


Fig. 20—Application of Webster Trap to Dressing Sterilizer

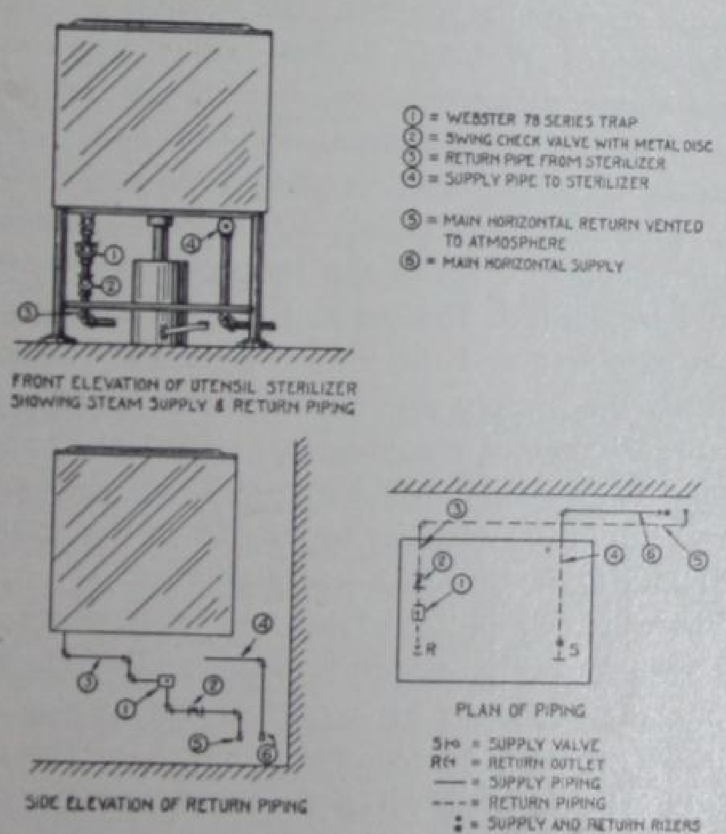


Fig. 21—Application of Webster Trap to Utensil Sterilizer

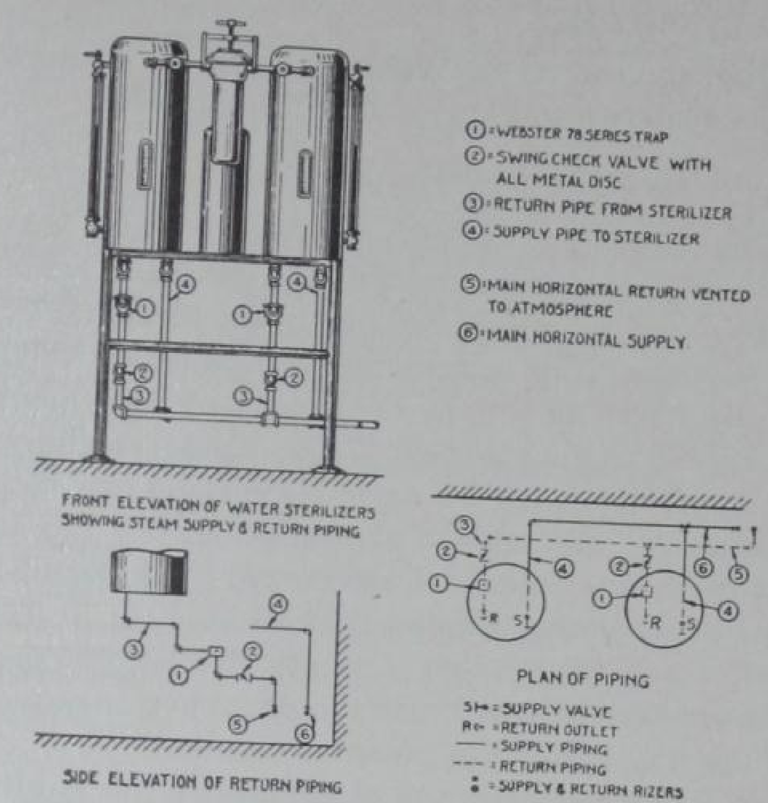


Fig. 22—Application of Webster Trap to Water Sterilizers

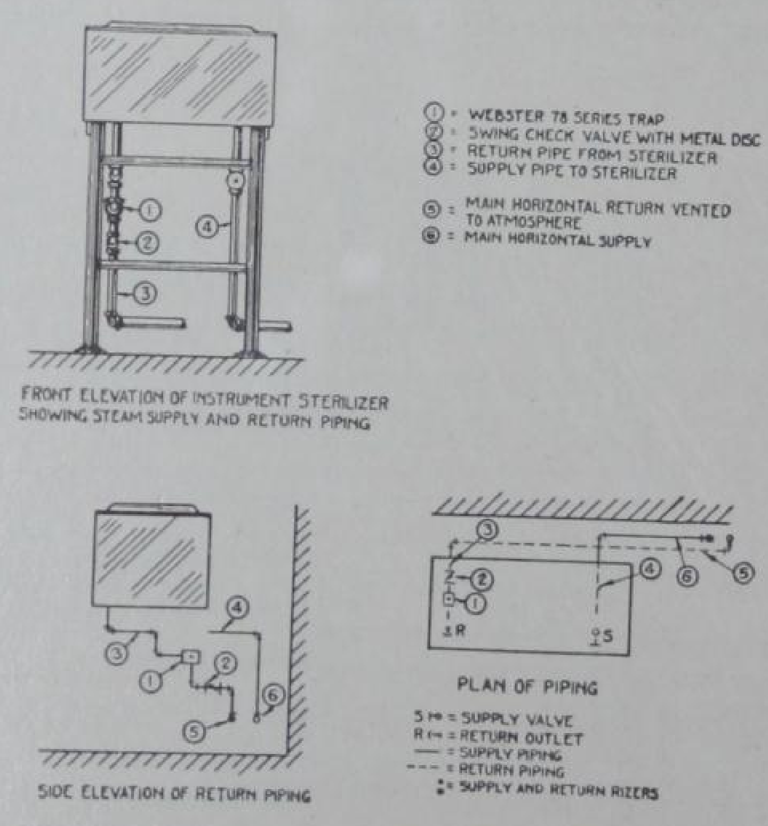


Fig. 23—Application of Webster Trap to Instrument Sterilizer

OPERATING STEAM PRESSURES FOR STERILIZERS

Sterilizer manufacturers generally require an operating steam pressure of not less than 30 pounds per square inch and not over 60 pounds. For satisfactory all-round results they specify a pressure of 40 pounds at the sterilizer.

APPLICATION OF WEBSTER TRAPS TO STERILIZERS

The application of Webster Traps to sterilizer units is shown in Figures 20 to 23, inclusive.

BATTERY OF STERILIZERS

The method of attaching Webster Traps to a battery of sterilizers and also the details of steam supply and return piping are shown in Figure 24. A Webster Trap is installed with a check valve in the return line from each piece of equipment, according to the standard Webster practice shown in Figure 12. It will be noted on the side elevation (Figure 24), that instead of connecting the trap directly to the horizontal return pipe marked 3, a small reservoir is formed back of the trap by the use of two elbows and a nipple. We believe that this arrangement will result in smoother operation of the trap and is the preferred method.

With the standard size of sterilizer furnished by a number of manufacturers, the size of the return pipe from the individual fixture is generally ⅜ inch. When the return piping arrangement shown on our illustrations is followed, the trap with ½-inch nipple should be used and the change in size from ⅜ inch to ½ inch made in the upper one of the two elbows, forming the offset of the reservoir.

If there is not sufficient space under the fixture for this method, the trap can be attached directly to the horizontal return pipe, using the ⅜-inch nipple and a coupling and locating the trap at about the same relative distance away for the sterilizer outlet.

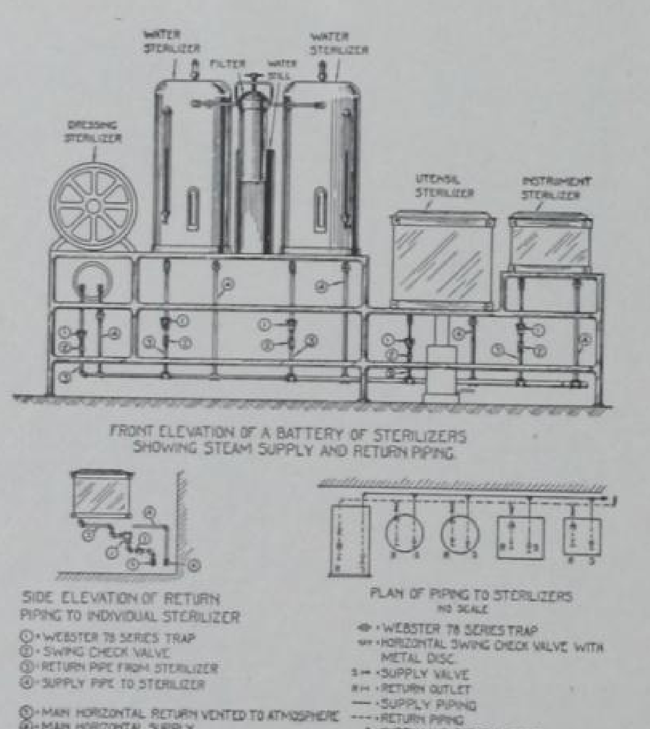


Fig. 24—Application of Webster Traps to a Battery of Sterilizers

"MASTER" TRAPS NOT SUITABLE FOR STERILIZER BATTERIES

While a separate trap for each piece of apparatus is accepted practice today, some older installations still use a single "master" trap to handle all condensation from sterilizer batteries. Heating up is slow and when a second piece of apparatus is turned on after the first one is in operation, the condensate backs up through the return outlet, producing snapping and water hammer, even if care is used in manipulating the valve which is always placed on each return outlet. Since the pressure in the main return pipe leading to the "master" trap is nearly as great as that in the supply piping, the movement of air out of the coil in the fixture is sluggish. The "master" trap does not pass the air readily and the apparatus does not heat up quickly. Frequently it has been necessary to provide air cocks to relieve the air from the system.

The use of Webster Series "78" Traps overcomes these disadvantages. It reduces the time of heating up to a minimum. When steam is first admitted to the sterilizer, the trap is cool and wide open, producing a relatively large opening for the rapid escape of air into the return piping, which should be vented. The pressure in the return piping is very low and the high differential pressure between the supply and return pipes produces a rapid discharge of condensate as soon as it accumulates. This results in quick heating up, obviously a most important feature, especially in the case of sterilizing apparatus in a hospital.

When the Series "78" Traps are used, the valve in the return outlet, which was generally supplied by the manufacturer as a part of his equipment, may be omitted, as the check valve in the discharge pipe from the trap prevents any backing up of water into the heating element when the apparatus is turned off.

Figures 20, 21, 22 and 23 show the application of the Series "78" Trap to each of the individual pieces of sterilizing apparatus.

The method of attaching a trap to the outlet of a Blanket Warmer is indicated in Figure 25. If the lower shelf is removable, the return piping, with trap and stringer, can be installed under the warmer as indicated in full lines. Otherwise the pipe should be placed at the side, as shown, so that the parts will be accessible.

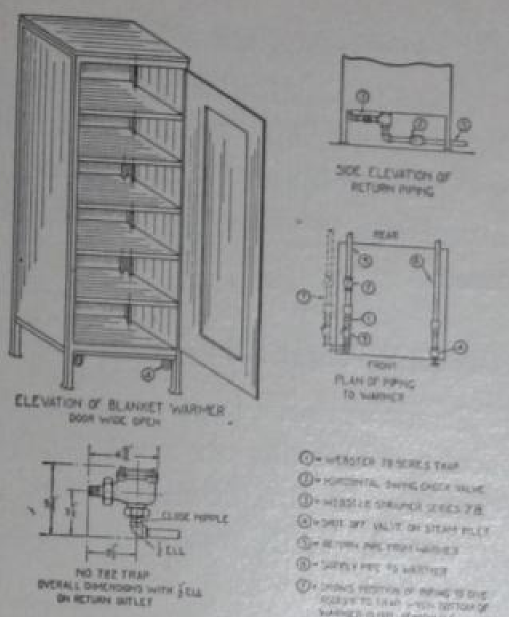


Fig. 25—Application of Webster Series "78" Trap to Blanket Warmer

COOKING EQUIPMENT

In this classification we include equipment in which cooking is done on sufficiently large scale to warrant the use of steam-jacketed utensils operating at pressures from 15 to 35 pounds per square inch. We exclude, however, large-scale cooking such as is done in confectionery and other food manufacturing plants. These latter are classified under the "process industries."

The principal classes of cooking apparatus in this group include:

Coffee and Hot Water Urns.	Roll Warmers.
Urn Stands (containing dish heating compartments).	Bakers' Proof Boxes.
Low Dish Heaters.	Oyster Cookers.
High Dish Heaters.	Steam Tables.
Jacketed Kettles.	Bain Maries.
Steam Cookers.	Egg Boilers.
	Dish Washing Machines.

URNS

Coffee and water urns are somewhat similar in construction to water sterilizers, and when heated by steam are provided with spiral coils, the inlet and outlet of which are located in the base. They are used either singly or in batteries of two or three. In the latter case the middle urn is usually for hot water and is provided with a valved connection to feed water to each of the coffee urns.

The following is a list of standard sizes of batteries of three urns supplied by one manufacturer.

Urns are usually mounted on stands which sometimes contain a plate or cup warmer. This consists

FOR APPROXIMATE UNIT STEAM CONSUMPTION OF KITCHEN APPLIANCES SEE APPENDIX ON PAGE 30

of an enclosed chamber, equipped with sliding doors on the front and having several rows of shelves under which are run pipe coils of ½-inch or ¾-inch pipe, supplied with steam in the usual manner. Sometimes an egg boiler is placed on a shelf attached to the urn stand. The heating element is a coil of small size brass pipe lying on the bottom of a rectangular tank holding the water.

A size 782 Trap is adequate to take care of an egg boiler, a warming closet or any one of the urns listed above. Where larger urns are installed the quantity of steam used can be readily figured according to the method described for sterilizers when the water content of the urn, the available steam pressure and the heating-up period are known.

JACKET KETTLES

Jacket kettles are used for making soup stock, boiling potatoes, making pastry and candy and in fact for any process where boiling is done. They are made of cast iron, copper, nickel or aluminum. Usually the jacket consists of an outer shell covering the bottom and extending about two-thirds up the sides. Steam is admitted into the space between the inner and outer shells, through a tapped opening part way up the side. The return outlet is at the lowest point of the bottom.

The limit of steam pressure for aluminum jacket kettles is 40 pounds. The makers usually supply a safety valve which is attached to the steam supply pipe and serves to prevent the pressure in the jacket space exceeding this amount. Jacket kettles are made in the following capacities: 10, 25, 40, 60, and 75 gallons and upwards.

STEAM TABLES

A steam table is a large water pan containing a pipe coil which rests on the bottom. A cover is provided over the entire top with holes into which dishes and pans of various shapes and sizes are set. The pan is partly filled with water which is brought to a boiling point by admitting steam to the pipe coil. Steam tables are made with and without warming closets, depending upon the particular requirements of the installation.

BAIN MARIES

The Bain Marie has a large water pan and pipe coil similar to the steam table. There is a perforated false bottom raised 2 inches above the bottom of the pan. No cover, with openings, is provided, the pots resting upon the false bottom and being surrounded by the heated water.

STEAM COOKERS

There are two types of steam cookers. One is usually rectangular and made up of one or more rectangular compartments provided with gasketed, tight-fitting hinged doors on the front. In operation the material to be steam cooked is placed in the compartment. Steam is usually supplied through a pressure-reducing valve and a hand-control valve and at a pressure to provide the desired cooking rate, usually 5 to 6 lbs. As the compartment is completely filled with air each time the door is opened, a Webster Process Steam Trap is provided to assure quick venting of this air and consequent faster cooking. To assure maximum venting speed the Webster Process Steam Trap discharges directly to the atmosphere since it is located above the condensate level. Condensate is accumulated in the bottom of the cooking compartment and later discharged to a drain.

In free-venting steamers a loop seal is provided, serving the twofold purpose of discharging accumulated condensation and acting as a water seal to prevent discharge of steam into the drain. This type employs no traps and must be provided with an open vent.

The second type of steamer has a steam jacket covering the bottom surface. Steam is supplied to this jacket when the apparatus is used for boiling. In addition a perforated pipe coil may be provided in the boiling compartment under a false bottom, providing live steam for cooking. A Webster Process Steam Trap is used to drain the condensation from the jacketed bottom.

WARMING CLOSETS

Warming closets, detached from urns or steam tables, are used in many hotels and restaurants, to warm plates, cups, etc. They are made of sheet metal in various sizes and contain a series of shelves beneath which are installed return bend pipe coils. Tight-fitting hinged or sliding doors serve to retain the heat during the warming-up period as well as to give access to the interior.

PROVING BOXES FOR BAKERIES

Many bakeries employ proving boxes to prove bread, rolls, etc. They are similar in design to the warming closets and contain in addition steam atomizers to spray steam vapor into the compartment.

DISH WASHERS

In a number of types of dish washers which have come under our observation, live steam is admitted directly to the compartment into which water is sprayed. With such an arrangement no trap is required.

OPERATING STEAM PRESSURES OF COOKING APPARATUS

The operating steam pressure recommended by manufacturers of cooking apparatus varies from 25 to 40 pounds, depending somewhat on the type of apparatus used and the volume of work which it has to perform. The limit of pressure allowable in aluminum jacket kettles is 40 pounds per square inch.

A seal on the return outlet of the *compartment steamer* will blow at very low pressures. It is necessary either to install a separate reducing valve for this piece of apparatus or to throttle down the pressure by the valve in the supply pipe. When the installation is of any size, the first-mentioned method is preferable.

In one case the manufacturers requested that the steam supply to the urns be reduced to 15 pounds, although the reasons for this reduction were not given.

STEAM REQUIREMENTS AND SIZES OF TRAPS FOR COOKING APPARATUS

The process of cooking, as in the case of sterilization, involves a transfer of the heat in the steam to the liquid or material. The quantity of steam used can be estimated in the same manner as for sterilizing equipment when all of the conditions are accurately known. In the case of Steam Tables, Bain Marie and Warming Closets it is necessary to know the square feet of heating surface.

Webster Series "78," Class 2, Traps are the proper ones to use on cooking apparatus unless it is found that for some special reason the operating steam pressure is greater than 60 pounds per square inch.

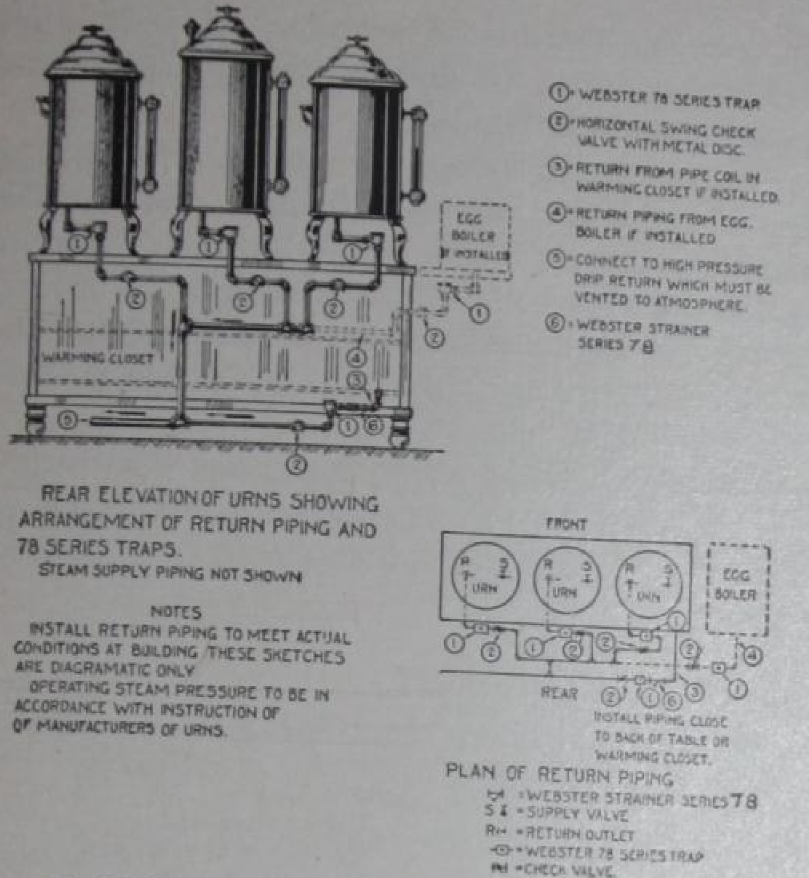


Fig. 26—Method of Connecting Webster Traps to Urns, Egg Boiler and Warming Closet

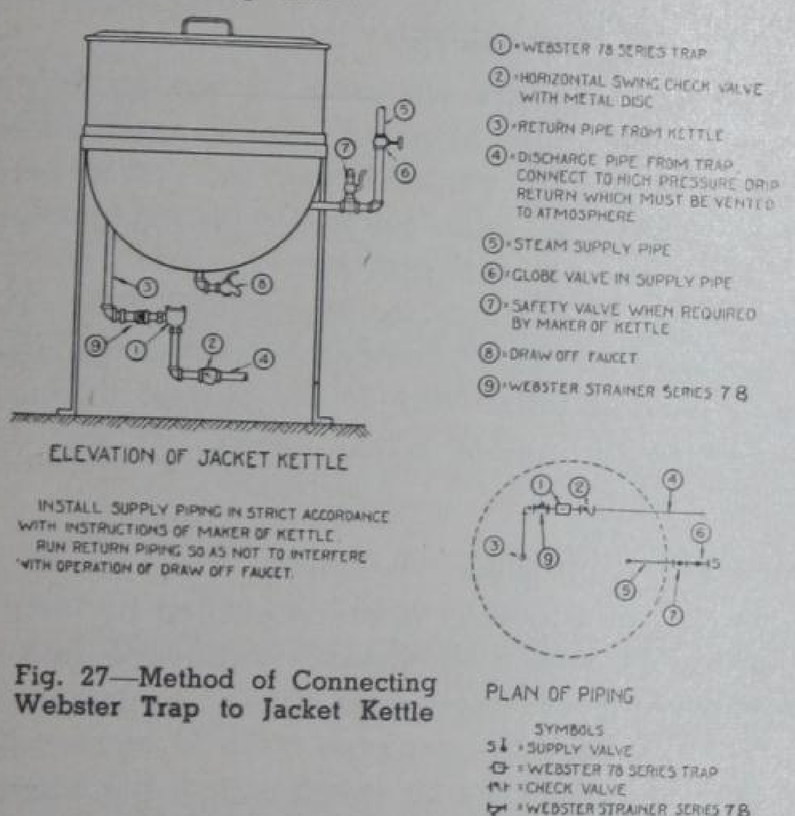


Fig. 27—Method of Connecting Webster Trap to Jacket Kettle

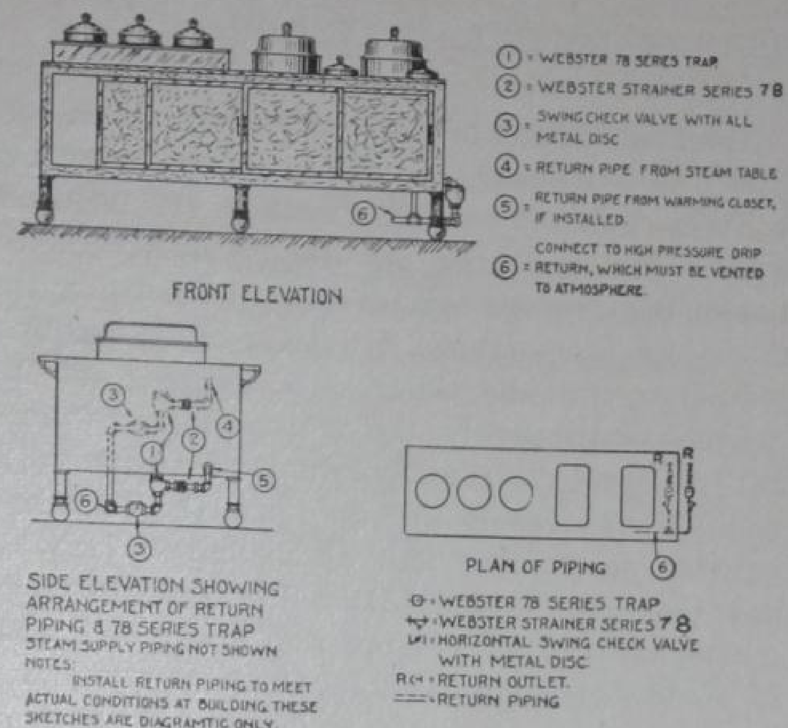


Fig. 28—Method of Connecting Webster Traps to Steam Table and Warming Closet

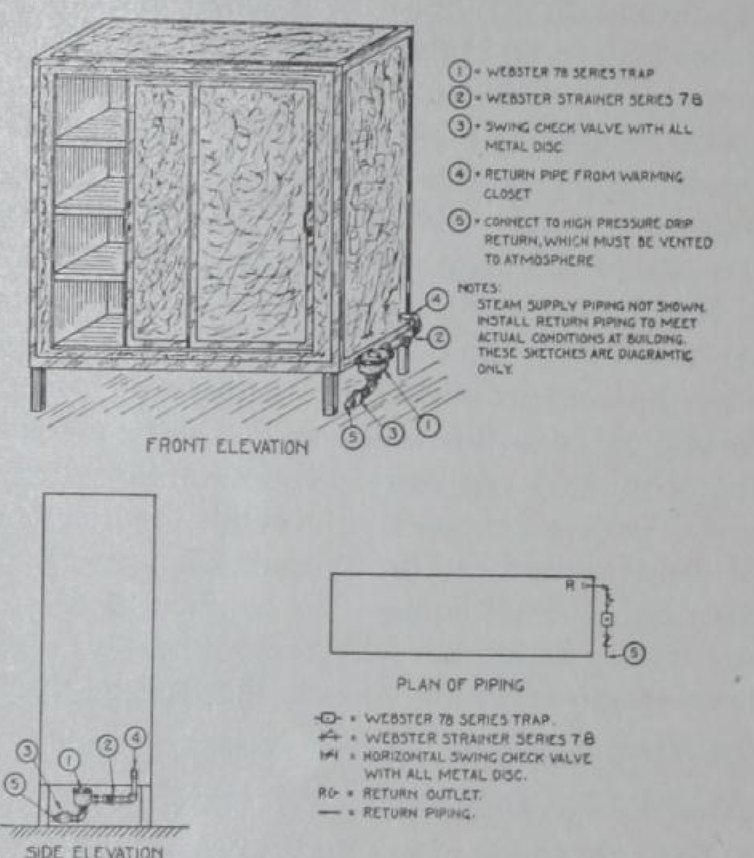


Fig. 29—Method of Connecting Webster Trap to Warming Closet

URNS AND EGG BOILER

For most coffee and water urns (see APPENDIX on page 30) and for the Egg Boiler, the size 782 Trap will be found adequate to take care of the increased amount of condensation when first turning steam into the cold apparatus.

WARMING CLOSETS

In the case of Warming Closets, containing pipe coils, the condensation is estimated in the same way as for any pipe coil installed under similar conditions. It will not exceed ½ pound of condensation per square foot of heating surface per hour. With a differential pressure as low as 20 pounds, the size 782, Class 2, Trap has a rating of 100 pounds of water per hour. This is equivalent to 200 square feet of heating surface in the warming coil, assuming the unit condensation rate of ½ pound per square foot. Unless the warming closet is of very large size, it is not likely to contain heating surface of this amount.

HEAT TRANSFER RATE OF COILS IN TANKS

The heat transfer rate of a coil of steel or wrought iron pipe immersed in a tank of still water such as a Steam Table or a Bain Marie is 150 B.t.u. per square foot per hour per degree difference between the average temperature of the water and the steam temperature. Assuming initial and final temperature of the water as 50 degrees and 212 degrees, respectively, the average temperature is 131 degrees. The temperature of steam at 30 pounds pressure is 274 degrees. The total heat transfer per square foot of heating surface per hour is $150 \times (274 - 131) = 21{,}450$ B.t.u., which corresponds to an average rate of approximately 25 pounds of steam per hour. Comparing the transmission rate of pipe coils in the pan of the steam table and in the warming closet, it is seen that the rate is nearly 50 times more when the coil is in water than in air. When first turning on steam the temperature difference between the water and the steam is greater than the amount given and the condensation rate is correspondingly increased. After the water reaches the boiling temperature, the rate is less than the amount stated.

When it is possible to obtain the dimensions of the water tank, the depth of water and the permissible heating-up period, the amount of steam required to raise the water to the boiling point in the given time can be readily found, following the methods given above and from this the hourly rate of condensation can be figured. This quantity can then be checked against the condensation rate of the coil to determine whether the heating surface is adequate to do the work in the desired time.

APPLICATION OF WEBSTER SERIES "78" TRAPS TO COOKING EQUIPMENT

The application of the Series "78" Traps to a battery of urns, with egg boiler and warming closet attached, is shown in Figure 26. Steam supply piping is not shown.

The piping connections to a Jacket Kettle are found in Figure 27. The manufacturers of aluminum kettles limit the steam pressure which is to be carried and furnish a pop safety valve which is to be placed in the supply piping to prevent excess pressure.

Steam tables are supplied with and without warming closets. The application of Series "78" Traps in the former case is shown in Figure 28. In case that there is no warming closet, it is perfectly clear from the drawing what portion of the piping should be omitted.

For connecting individual warming closets, Figure 29 should be followed. Since the heating elements in the apparatus shown on both drawings consist of pipe coils, Webster Series "78" Strainers should be installed ahead of the traps to intercept the pipe scale, chips and bits of metal inevitably found in coils.

Note: With all of above apparatus it is recommended that the piping contractor follow the apparatus manufacturers' instructions in installing supply piping.

LAUNDRY MACHINERY

Laundry machinery using steam for heating includes the following:

Flat Work Ironers.	Collar Presses.
Drying Tumblers.	Conveyor Dry Rooms.
Prim Presses.	Stocking Dryers.
Starch Cookers.	

FLAT WORK IRONERS

Flat Work Ironers are used for ironing sheets, towels, tablecloths, blankets, napkins, and similar pieces. One type consists of two, four, six or eight hollow cast iron rolls, covered with felt padding and operating in cast iron steam chests, concave in shape, to conform to the padded rolls. The other type consists of one or more steam cylinders with padded rolls. Two of the largest manufacturers make ironers having rolls 100 and 120 inches long.

DRYING TUMBLERS

Drying in a tumbler is accomplished by forcing thoroughly heated air through the goods as they revolve in a screen cylinder. The air is previously heated by passing over pipe coils. In some cases a portion only of the air is exhausted, the balance being re-circulated with the addition of the proper quantity of fresh air. The machines are made in a number of sizes, each having a different length of cylinder. The cylinder diameter is the same in all cases. The size of the coils is substantially in proportion to the length of the cylinder. The machine is used for drying such material as Turkish towels, which are first passed through an extractor to remove as much of the water from them as possible. When first placed in the drying tumbler the towels are cold and damp and the con-

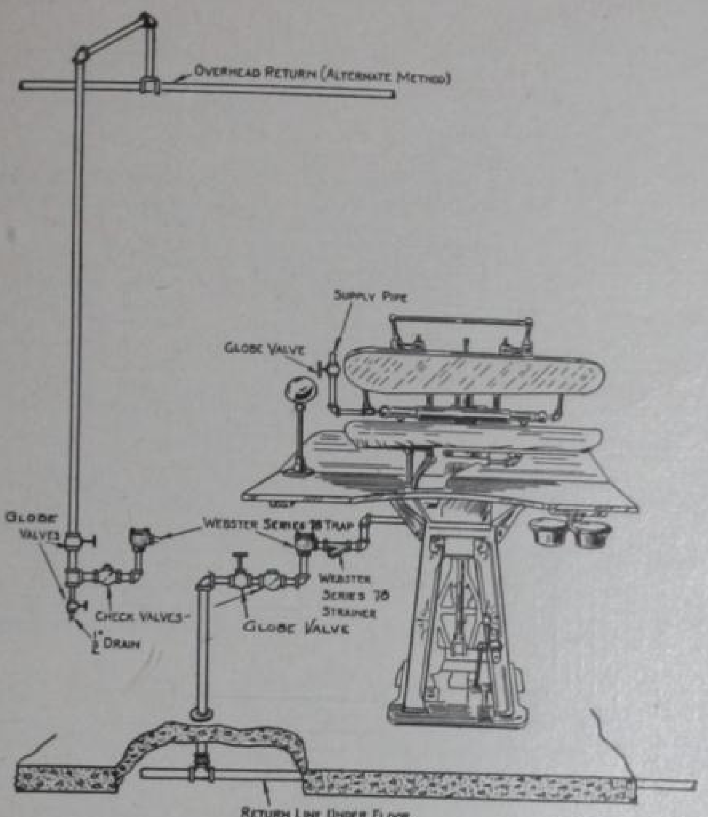


Fig. 30—Method of Connecting Webster Series "78" Trap to Steam Press

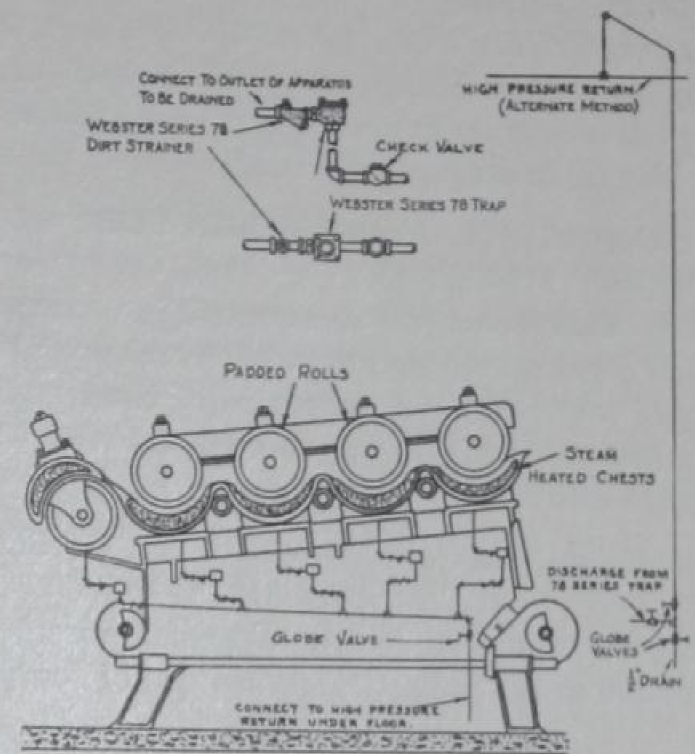


Fig. 32—Method of Connecting Webster Series "78" Trap to Five Roll Flat Work Ironer

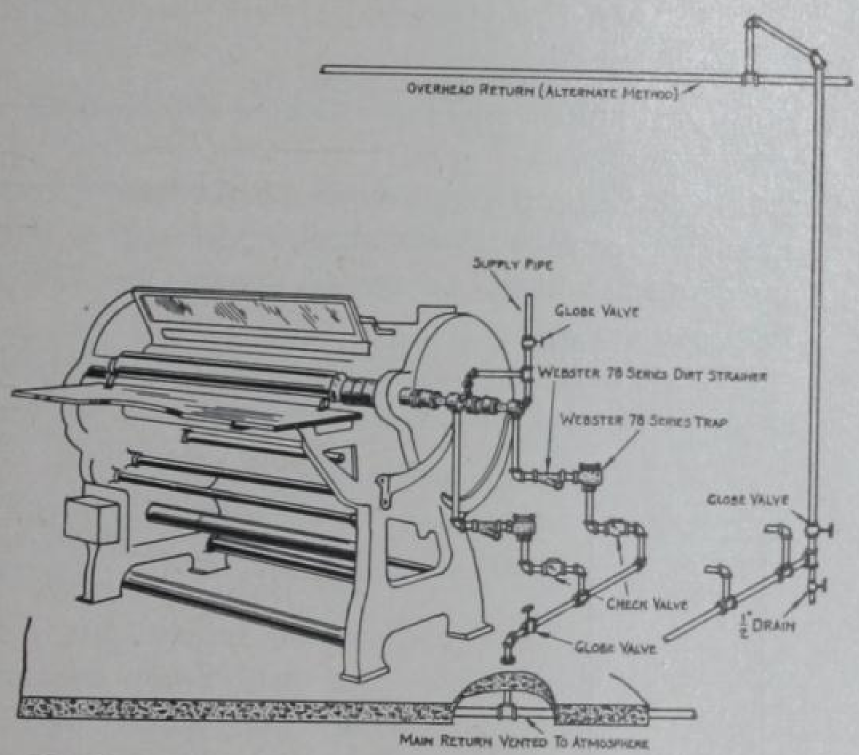


Fig. 31—Method of Connecting Webster Series "78" Trap to Collar Ironer

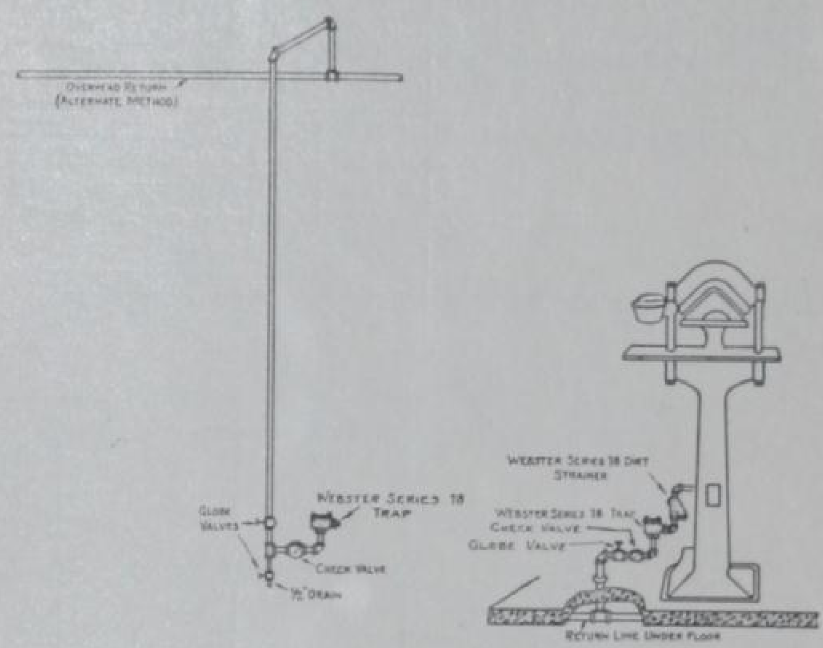


Fig. 33—Method of Connecting Webster Series "78" Trap to Cuff, Yoke and Neckband Press

densation rate is accordingly very heavy. The process is continued until they are dry.

PRIM AND COLLAR PRESSES

White linen coats, aprons, etc., are ironed in a prim press which consists of a hollow cast iron buck and a movable hollow iron head into which steam is admitted. The buck is covered with a soft thick felt padding. In the collar press there is a hollow cast iron steam chest of compound curve shape against which the material is pressed by means of a movable padded plate. The machine is used for pressing either the collar or collar-attached shirts or the neckbands of plain neckband shirts.

CONVEYOR AND COMPARTMENT DRY ROOMS

The conveyor dry rooms are heated by coils which extend along two sides and the rear of the room. These coils are usually made of 1¼-inch pipe, with return bends. In a compartment dry room there are center coils extending from front to rear. Each should have its own trap.

STARCH KETTLES

Starch, to work easily and to the best advantage, must be kept at a high temperature, and for this purpose jacketed steam kettles are used sometimes encased in an insulated covering to retain the heat.

OPERATING STEAM PRESSURES FOR LAUNDRY MACHINERY

The manufacturers recommend an operating steam pressure ranging from 100 to 125 pounds per square inch with the exception of certain pieces of apparatus such as starch cookers, which may require a lower temperature.

STEAM REQUIREMENTS AND SIZES OF SERIES "78" TRAP FOR LAUNDRY MACHINERY

All apparatus subjected to steam pressures of from 100 to 125 pounds pressure will of course require the Class 3 Trap of the proper size. Where special apparatus is installed operating at pressures which will not exceed 60 pounds, the Class 2 Trap can be used.

Table XV—Sizes of Webster Process Steam Traps Required for Typical Laundry Equipment

Name of Machine	Number and Size of Traps for Steam Pressures up to 150 lbs.
Flat Work Ironer—2 Roll Flat Work Ironer—4 Roll Flat Work Ironer—6 Roll Flat Work Ironer—8 Roll	2—½" Model 782 Traps 4—½" Model 782 Traps 6—½" Model 782 Traps 8—½" Model 782 Traps
Drying Tumblers	¾" Model 783, 1" Model 784, or 1" Model 794-T Trap (as required by size of machine) on each heating coil
Small Presses for Collars, Cuffs, etc.	1—½" Model 782 Trap

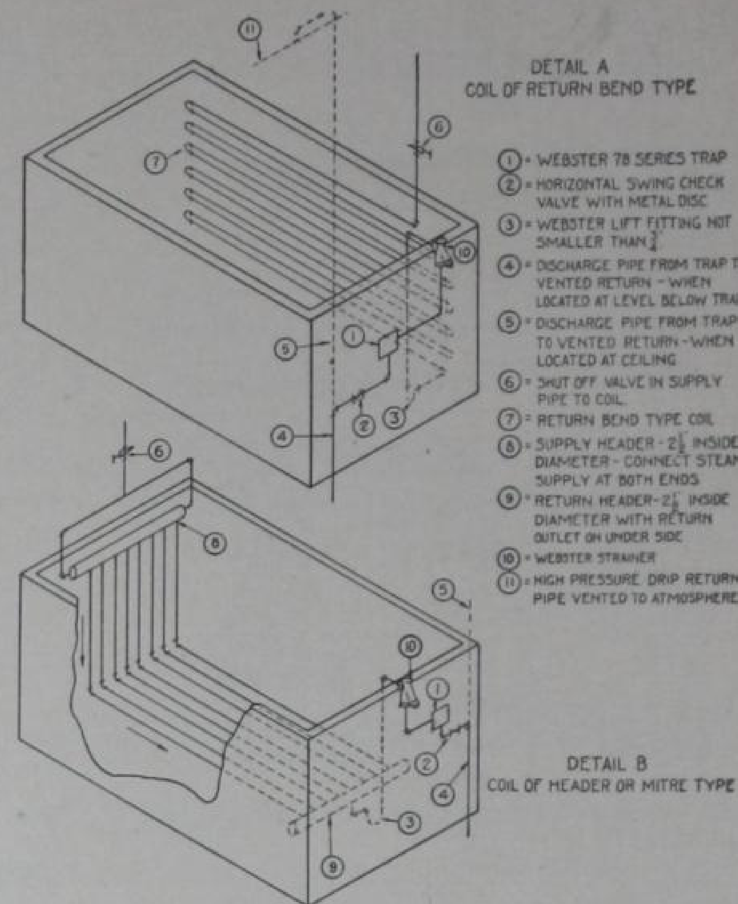


Fig. 34—Application of Webster Series "78" Traps to Pipe Coils of Header and Return Bend Type—Installed in Open Tanks

All data received from the manufacturer is given in terms of total pounds of steam used in an hour without regard to the maximum condensation rate when first starting up the apparatus or when introducing a lot of cold damp material. A trap sized on the manufacturer's figures would be inadequate for the maximum load and the machine would be slow in heating up due to holding up of condensation.

In order to assist in selecting the proper size of Series "78" Traps for laundry machinery, we have prepared the table above. The traps are not sized upon the

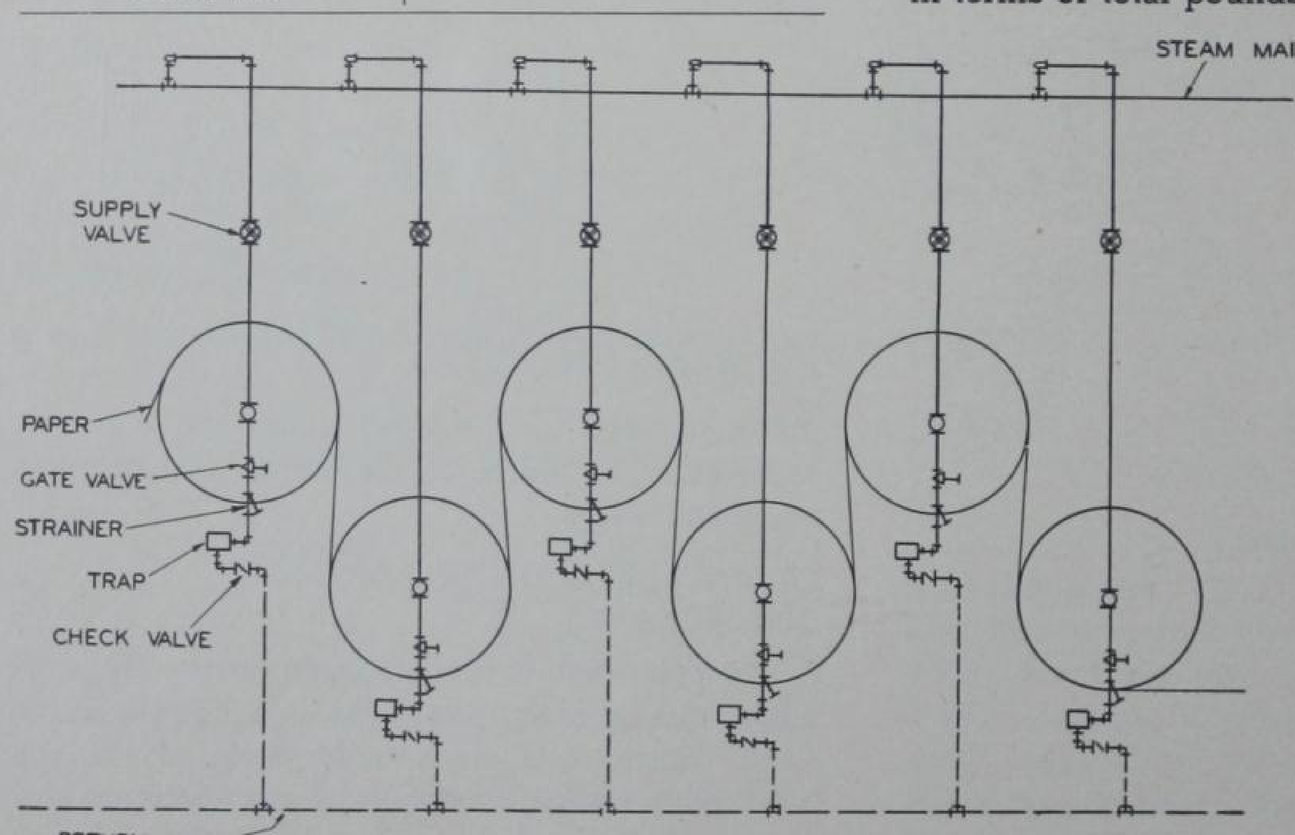


Fig. 35—Diagrammatic Arrangement of Rollers in Paper Drying Process Showing Steam and Return Connections

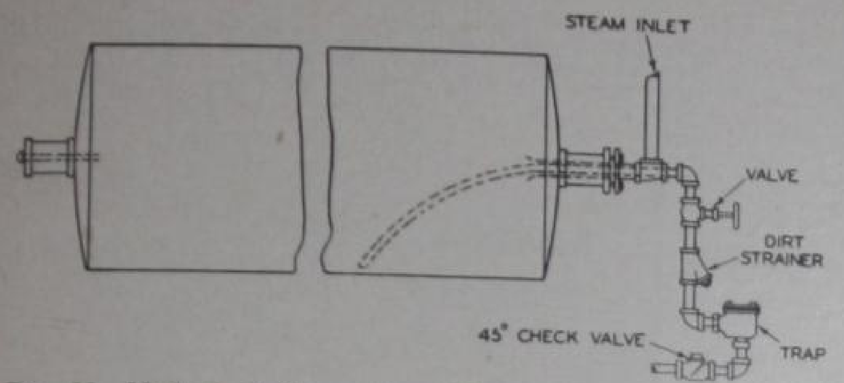


Fig. 36—Method of Connecting Webster Series "78" Trap to Revolving Cylinder

total condensation taking place for the period of an hour, but upon the hourly rates under maximum or peak load conditions, occurring usually when the apparatus and the material are warming up.

PAPER DRYING MACHINES

Drying machines are used in the manufacture of paper and consist of many large steam cylinders. See Figure 35. These cylinders revolve as long continuous sheets of paper pass over and around them. As the paper comes in contact with the first cylinder it is very wet and gradually dries as it continues down the long battery of hot rollers. The condensation rate of the different rollers is, of course, quite variable and individual traps will provide greater efficiency than a master trap for several rollers.

REVOLVING CYLINDERS OR PANS

Frequently condensate must be drained from a revolving cylinder or drum and must be removed through the trunnion while the steam container is in motion. Cases of this are tilting pans and revolving drums such as those used in paper drying. Figure 36 shows piping detail for a revolving cylinder. It will be noted that a condensate pipe is inserted into the bottom of the container where the condensate gathers. The pipe is located above the trap so that nearly complete drainage will be accomplished.

HOSIERY DRYING

Hosiery dryers are generally hollow aluminum forms over which the product is placed and steam is admitted to the inside. Sometimes 10 or 12 of these forms are on one supply header, the condensate and air from the header being dripped through one trap. See Figure 37.

OPEN TANKS OR VATS

Open tanks or vats containing pipe coils constitute one of the commonest types of steam-using equipment in the process industries, textile and other fields.

There are two well-known forms of coils, the return bend type and the header type. Figure 34 shows the method of attaching Webster Series "78" Traps to both types. Instead of running the return pipe from the outlet directly through to an opening in the end of the tank, it is carried up over the top and the trap with the strainer is installed on the outside of the tank.

Tests and actual installations show that this method will satisfactorily pass the air and condensation from the coils. It was also found that the trap would discharge with more uniform regularity when a Webster Lift Fitting was placed in the lowest point of the return pipe at the point marked three.

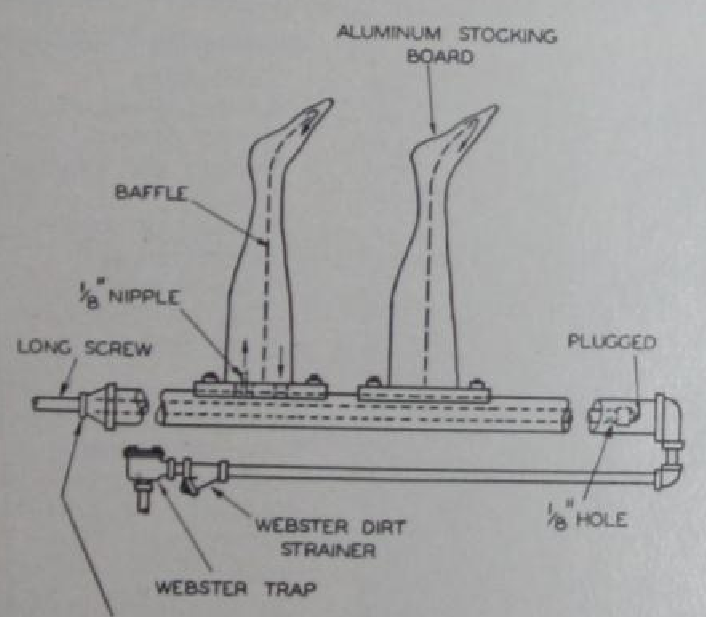


Fig. 37—Method of Connecting Webster Series "78" Dirt Strainer and Webster Trap to Stocking Dryer

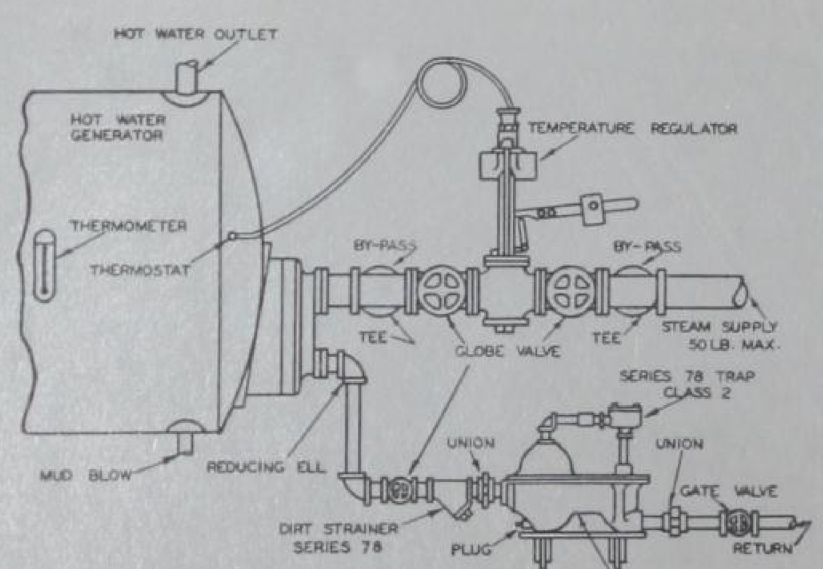


Fig. 38—Method of Dripping Hot Water Generator Through Webster Series 23 Heavy Duty Trap with Webster Series "78" Trap for Venting Air

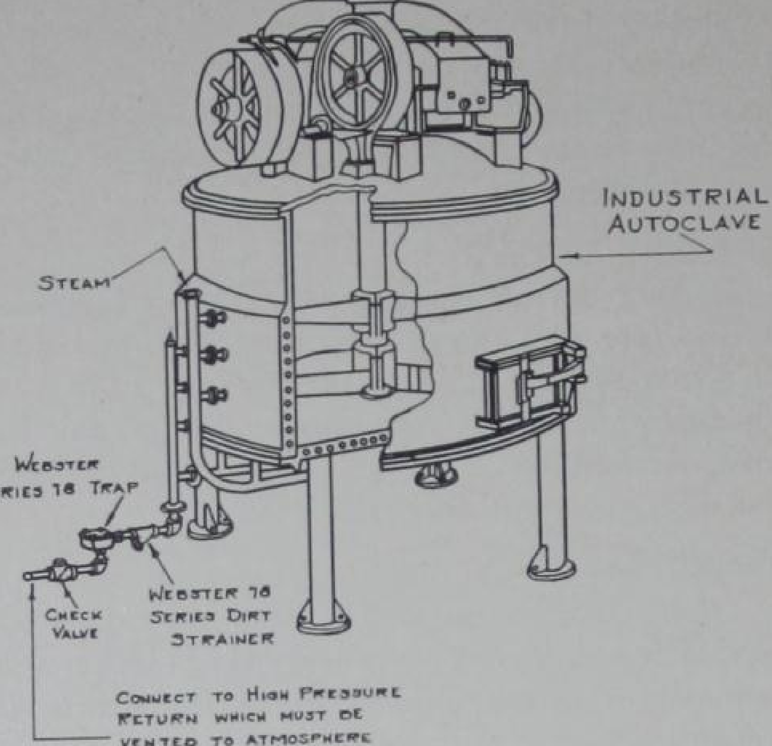


Fig. 39—Method of Applying Webster Series "78" Trap to Industrial Autoclave with Mechanical Mixer

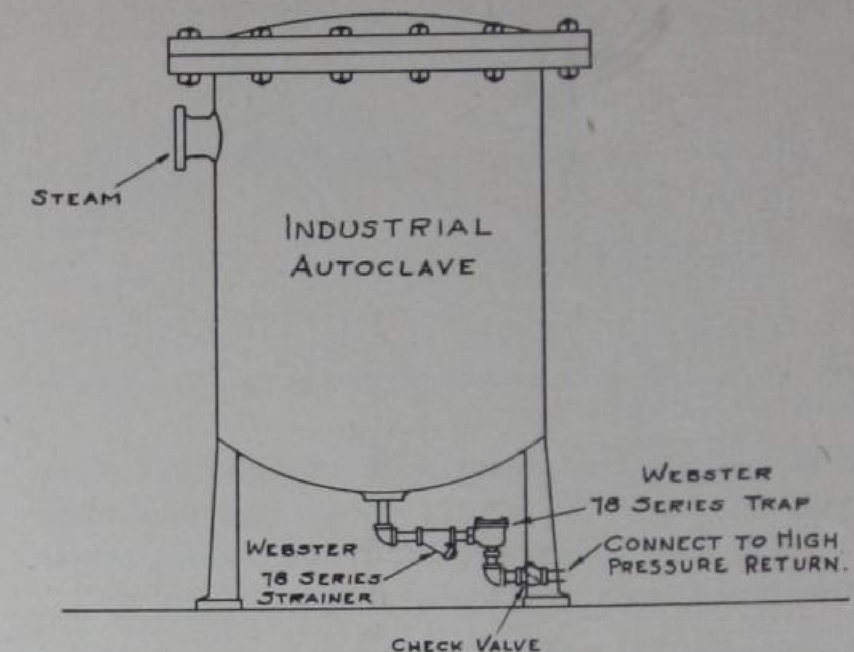


Fig. 40—Method of Applying Webster Series "78" Trap to Typical Industrial Autoclave

If the conditions are such that it is necessary to install the main vented return pipe at the ceiling, the discharge pipe from the trap can be run vertically upward as shown by the dotted lines. The height to which the condensate can be elevated will depend upon the differences between the minimum pressure in the coil when steam is turned into the cold pipes and the maximum counter or back pressure in the return main.

The lift will be more effective if the trap is placed at the top of the vertical pipe discharging through a check valve into an outlet in the *top* of the horizontal return main.

SHIP HEATING

Steam is the most widely used medium for ship heating. Steam pressures utilized range from about 15 pounds to 75 pounds per square inch, although present-day practice generally calls for 15 pounds to 25 pounds. Series "78" Traps because of their efficiency and, more important, their dependability have been placed on ships of various type.

All sizes of Webster Series "78" Traps and Strainers have been approved and installed on a number of U. S. naval vessels under Navy Department specifications.

OTHER APPLICATIONS

There are innumerable other industries or operations in which process steam is used and to which the Webster Traps may be applied. A few of these are here listed:

- Vulcanizing
- Heating glue pots
- Drying gloves
- Melting and cooking candy
- Heating hat molds
- Drying ovens in laboratories
- Food dehydrators
- Many chemical processes

For application of Webster Traps to these processes, write the Company at Camden, New Jersey, or the Webster Representative nearest you.

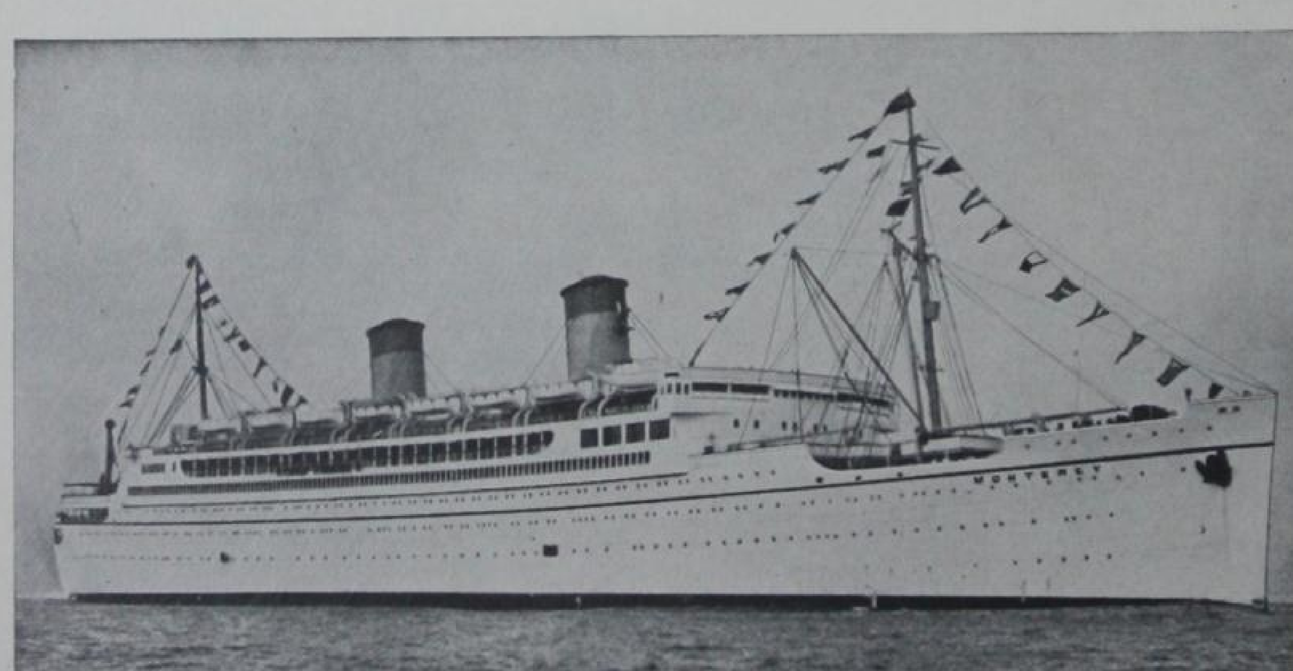


Fig. 41—The S. S. Monterey, shown at left, and her sister ship, The S. S. Lurline, are equipped with Webster Series "78" Traps.

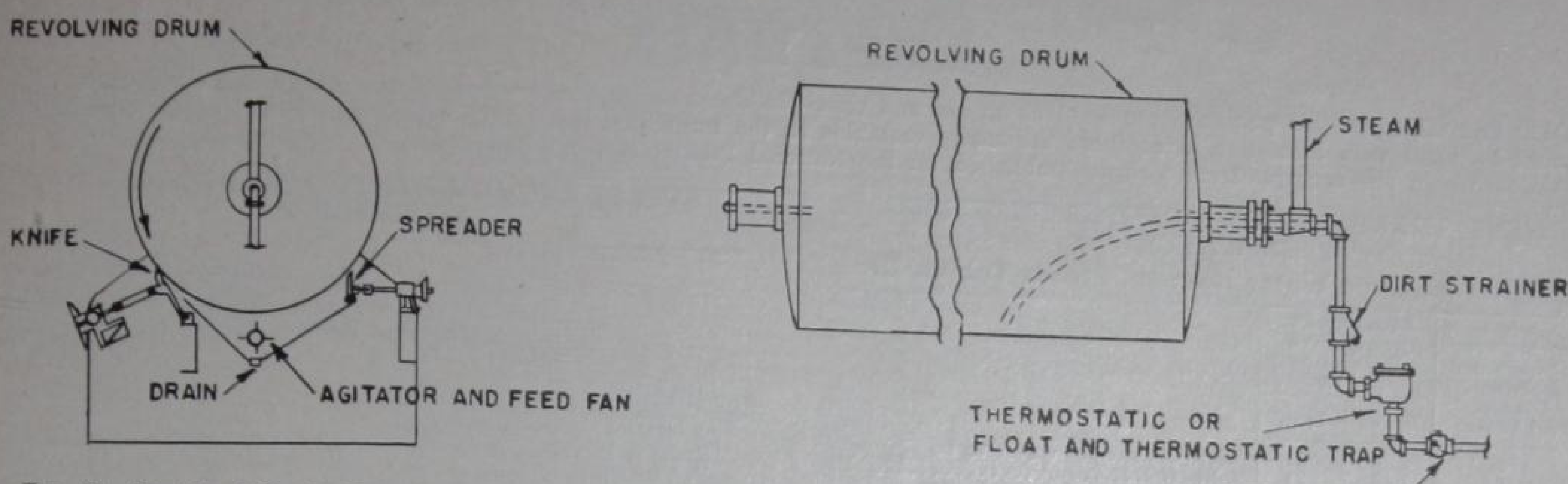


Fig. 42—Sketch of Single Drum Dryer for Dehydrating Juices, Showing Method of Draining Drum of Condensation and Air

FOOD DEHYDRATION

Steam is used extensively for the dehydration of food. In many cases the steam is used to heat air (by means of fin type units), which is then picked up by fans and passed over the food to be dried. In other cases large revolving cylinders, as in Figure 42, are heated by steam and the food (generally juices) to be dried is spread over the revolving drum, where it is dried and then by means of scrapers is collected into a pan below the drum.

FOOD PROCESSING

Steam is also used extensively for processing food. The food after being placed in containers is loaded into large kettles, where it is cooked (see Figure 43). It is necessary to drain off the condensation from the bottom of the kettle. Another important thing is the quick removal of air from the kettle when starting. For this purpose a Webster Thermostatic Air Relief Valve is installed at the top of the kettle. When all the air is removed the trap closes to prevent the loss of steam.

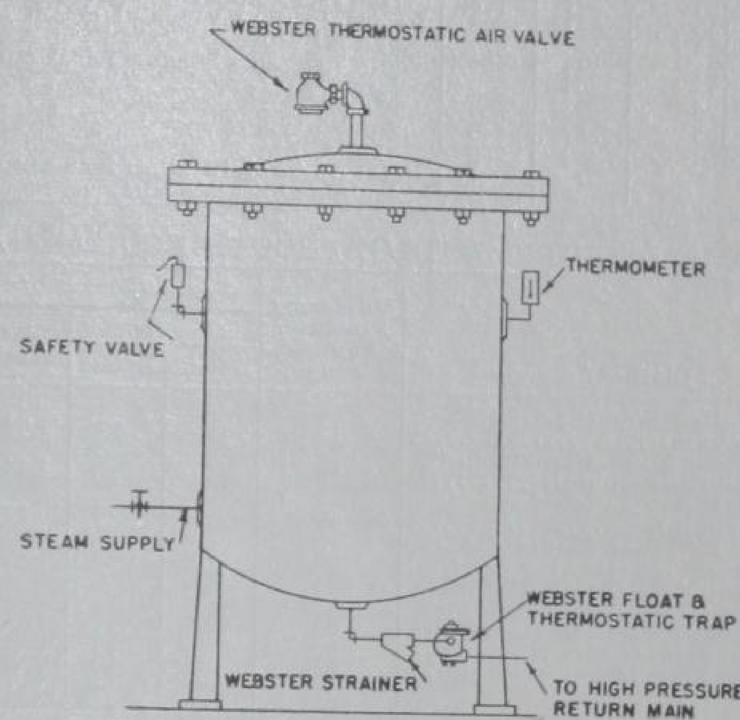


Fig. 43—Method of Draining Condensation and Venting Air From Food Processing Kettle

STANDARD GUARANTEE—We guarantee Webster equipment against defects in workmanship and material for a period of one year from date of shipment from our factory, but this guarantee will be limited to furnishing new parts in exchange for any that may prove defective within such period, f.o.b. Camden, N. J., provided the installation has been made and the heating plant operated in accordance with our Service Details and Instructions.

This guarantee does not include liability for installation costs or contingencies of any character.

APPENDIX

NOTE: The tables on this page are provided as an aid and check in determining steam requirements of process equipment. They should be used with discretion since there are many variables in the individual installation which may affect steam consumption. The data given are excerpts from a report published for the National District Heating Association, R. M. McQuitty, author.

HEAT TRANSMISSION OF PIPES IMMERSED IN WATER

(For Storage Type Water Heaters, Steam Tables, Etc.)

Temperature Difference Between Steam and Water	Btu./Sq. Ft. per Degree Difference per Hr.	
	Brass	Iron
6	32	21
10	48	31
20	72	46
30	103	65
40	125	80
50	144	92
60	167	107
70	186	119
80	213	136
90	233	149
100	250	160
110	273	175
120	292	187
130	307	196
140	321	205
150	333	213
160	343	220
170	359	230
180	372	238
190	387	249
200	400	256

Example

Temperature of water to be heated....................180° F.
Temperature of water before heating.................... 36°

Mean temperature of water heated....................108° F.
Assume steam temperature 5# gauge....................228°
Mean temperature of water..108°

120°

Btu. transfer at 120° differential for Iron Pipe = 187 × 120 = 22,440 per hr.
Latent heat of vapor of steam at 5# = 983 Btu.
Pounds steam per square foot surface =

$$\frac{22{,}440}{983} = 22.8$$

Note: Above data allow for normal fouling of heating surface.

STEAM REQUIREMENTS OF PROCESS EQUIPMENT

Clothes Presses	Operating Pressure, Pounds Gauge	Pounds Steam Use Per Hr. Max.	Pounds Steam Use Per Hr. In Use	Per Week
U. S. Hoff-Man (electric vacuum)....................	18	...	25	1,000
Excelsior Mach. Corp. Mod. 460 (electric vacuum)............	30	...	...	1,700
U. S. Hoff-Man (electric vacuum)....................	30	...	25	800
U. S. Hoff-Man Mod. U.C.O.-5 (steam operated vacuum)....	50	67.2	38.1	.....
Steam Vac. Jet on Hoff-Man Press. Venturi Type, Max. Instantaneous Use (Jet Only)	50	58.0	...	.....
Large Press (steam vacuum) ...	65	...	30	.....
Large Press (electric vacuum)..	65	...	20	.....
Laundry Equipment				
Tumbler (drying machine)				
Size 40" x 94"..................	80-100	...	360	.....
Size 30" x 36"..................	80-100	...	225	.....
Mangle (flat work ironer)				
Size 8 Roll..................	80-100	...	480	.....
Size 6 Roll..................	80-100	...	415	.....
Large Shirt Body Press.........	80-100	...	190	.....
Cuff and Neck Band Press......	80-100	...	15	.....
Standard Press..................	80-100	...	105	.....
Feather cleaning and sterilizing (capacity 15 pillows per hour)......................	80-100	...	175	.....

STEAM REQUIREMENTS FOR PROCESS EQUIPMENT

	Cap. Bottles	Depth of Water	Operating Pressure, Pounds Gauge	Lb. Steam per Hour Max.	Lb. Steam per Hour In Use
Sterilizers (Non-Pressure Type)					
For Bottles or Pasteurization.					
Start with water at 70° F. Then maintained at boiling for period of 20 minutes	36	3"	40	36	36
	54	3"	40	51	51
	72	3"	40	69	69
For Instruments and Utensils	Size				
Start with water at 70°. Then boil vigorously for period of 20 minutes.	8" x 9" x 18"	3½"	40	27	27
	9" x 20" x 10"	3½"	40	30	30
	10" x 12" x 22"	4"	40	39	39
	12" x 16" x 24"	4"	40	60	60
	10" x 12" x 36"	4"	40	66	66
	16" x 15" x 20"	10"	40	92	92
	20" x 20" x 24"	10"	40	144	144
Sterilizers (Pressure Type)	Size				
For Surgical Supplies.	12" x 20"		40	22	22
Sterilizing period, 30 minutes at temperature of 240°-250° F.	14" x 22"		40	28	28
	16" x 24"		40	38	38
	16" x 36"		40	54	54
	20" x 28"		40	60	60
	20" x 36"		40	78	78
	20" x 48"		40	.98	98
	20" x 60"		40	124	124
	10" x 20"		35-60	9.5	9.5
	24" x 48"		35-60	50.0	50.0
For Instruments.	12" x 20"		40	48	48
Sterilizing Period. 20 minutes	14" x 22"		40	60	60
at 240°-250° F.................	16" x 24"		40	72	72
Sterilizers (Pressure Type) (Autoclave)	Size				
Sterilizing period, 30 minutes at 240°-250° F.........	15½" x 24"		40	24	24
	17½" x 26"		40	32	32
	21½" x 30"		40	40	40
	24" x 36"		35-60	42	42
Water Sterilizers	Cap., Gals.				
Start with water at 70° and maintain at temperature of 240°-250° F. for 15 minutes..	6		40	76	76
	10		40	120	120
	15		40	180	180
	25		40	300	300
	50		40	600	600
Unit Requirements for Water Sterilizer = 2.5 lb. steam per gal. sterilized..........			35-60	...	...
Mattress Disinfector					
Size 30" x 42" x 84"......................			35-60	...	42
Size 60" x 66" x 108"......................			35-60	...	318
Blanket Warmer					
Size 18" x 24" x 72"......................			35-60	...	4

APPROXIMATE UNIT STEAM CONSUMPTION OF KITCHEN APPLIANCES

Appliance	Lb. Steam per Hour
Stock and Vegetable Kettles (per 5 gal.)...............	20.0
Coffee Urns (per gal.)...............	3.4
Water Urn (per gal.)...............	5.0
Steam Tables (per sq. ft.)...............	1.7
Plate and Cup Warmers (per 20 cu. ft.)...............	35.0
Steam Cookers (per compt.)...............	40.0
Soup Warmer, 30" x 30" x 28"...............	100.0
Clam, Lobster and Potato Steamers (per compt.)....	40.0
Egg Boilers (3 compts.)...............	18.0
Oyster Pots...............	18.0
Bain Marie (per sq. ft.)...............	3.4
Food Warming Ovens (per 20 cu. ft.)...............	35.0
Silver Burnisher and Washer...............	69.0
Dish Washer (per tray)...............	60.0

Note: Above figures represent average operating conditions after warm-up period and do not include hot water. Pressures will vary from 7 to 20 lb. gauge.

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To protect ourselves in our constant endeavor to make Webster Systems of Steam Heating and Webster System Equipment ever better, we reserve the right to change specifications and prices without notice.

Form No. C-650B—F, January, 1954—10M

Printed in U.S.A.

Webster "78" TRAPS

FOR PROCESS STEAM HEATING

Webster

MATÉRIEL DE CHAUFFAGE

ROBINETS DE RADIATEURS WEBSTER

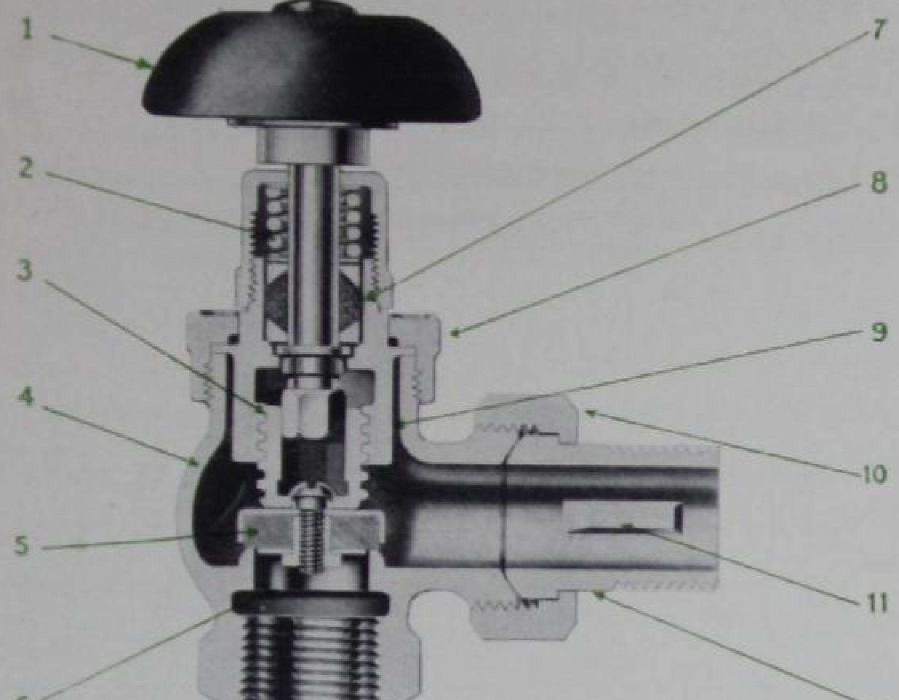


Fig. 1 — La garniture du robinet Webster (Série 600P) Type "WB-P" est retenue par un ressort.

Type WB-P pour chauffage à basse pression

Le robinet Webster Type WB-P peut être spécifié et recommandé lorsque des robinets de radiateurs de toute première qualité sont désirés.

Le robinet Type WB-P est en parfaite conformité avec les devis exigeant un robinet "à ressort sans garniture". Un solide ressort exerce automatiquement une pression sur la garniture d'anneaux métalliques matricés.

Bien que la garniture ait très rarement à être renouvelée, ce robinet est conçu de façon à pouvoir enlever la vieille garniture et à en poser de la nouvelle tout en conservant la pression sur le système.

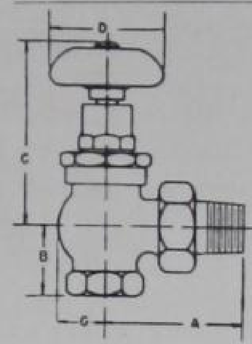
Pression

Pour vapeur à basse pression et chauffage à vapeur par le vide.

Particularités de fabrication

1. Un volant ne s'échauffant pas ouvre le robinet en moins d'un tour. La tige est fixe.
2. Un fort ressort exerce automatiquement une pression sur la garniture pour empêcher toute fuite de vapeur.
3. Les filets Acme, profonds et longs, de la tige du robinet accordent une grande résistance et facilitent la manoeuvre.
4. Corps en cuivre pour la vapeur. A remarquer l'épaisseur libérale et uniforme du métal.
5. Le disque plastique renouvelable dans un robuste porte-disque en cuivre assure une parfaite étanchéité.
6. La douille de modulation (non illustrée) est fournie sur demande seulement sur les diamètres de ½, ¾ et 1", moyennant légère majoration.
7. La garniture annulaire en métal matricé empêche les fuites et lubrifie la tige du robinet qui peut être regarni sous pression.
8. Le chapeau est en cuivre. Des flèches indiquent la direction de la manoeuvre.
9. L'écrou-guide de la tige, entièrement usiné, maintient toutes les pièces alignées.
10. Ecrou de cuivre entièrement usiné.
11. Un mentonnet surépais fournit une résistance supplémentaire au volant.
12. Le mamelon de l'union est usiné à même une tige de cuivre solide.

Table I. Dimensions des robinets Type WB-P, modèle d'équerre



Symbole	Dia. pouces		Dimensions approx., pouces				
	Entrée	Sortie	A	B	C	D	G
W602PH	½	½	2¾	1⅜	3⅝	2¼	15/16
W603PH	¾	¾	2¾	1⅜	3⅝	2¼	15/16
W604PH	1	1	3⅛	1⅜	3 13/16	2¼	1 1/16
W605PH	1¼	1¼	3⅝	1⅞	4 13/16	3	1 7/16
W606PH	1½	1½	4	2	5	3	1⅝

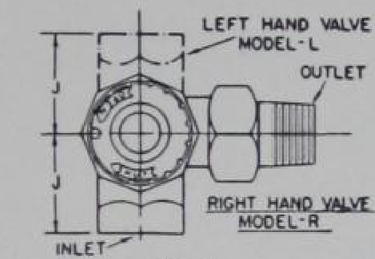
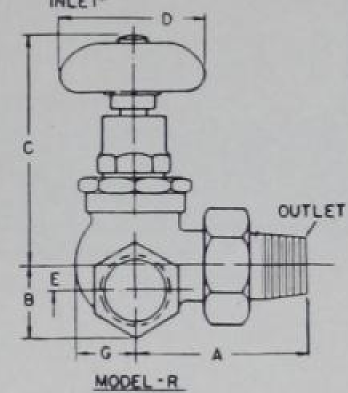
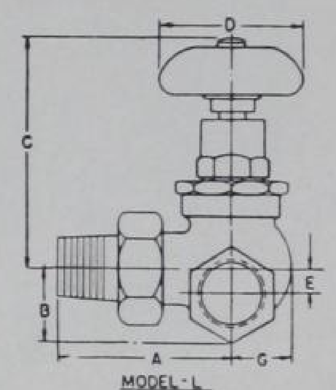


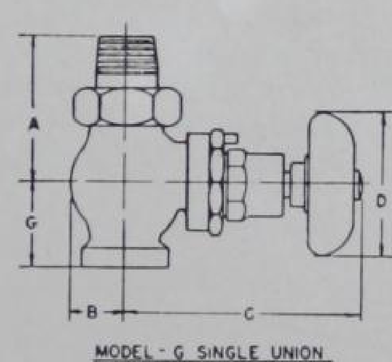
Table I-A. Dimensions des robinets Type WB-P, modèles pour la droite et la gauche.

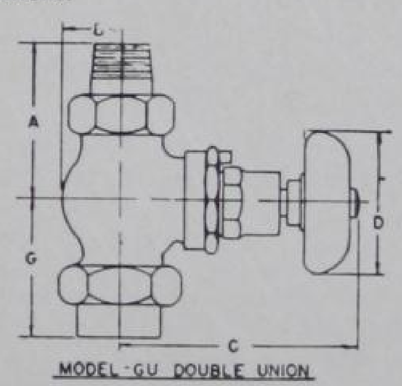




Symbole	Dia. pouces		A	B	E	G	J	C	D
	Ent.	Sort.							
W612PR, W622PL	¾	½	2¾	1 3/16	⅜	15/16	1 9/16	3⅝	2¼
W613PR, W623PL	¾	¾	2¾	1 3/16	⅜	15/16	1 9/16	3⅝	2¼
W614PR, W624PL	1	1	3⅛	1⅜	7/16	1 1/16	2 1/16	3 13/16	2¼

Table II. Dimensions des robinets Type WB-P, modèle droit, à une ou deux unions.





Symbole	Dia. pouces		Dimensions approx., pouces				
	Entrée	Sortie	A	B	C	D	G
DROIT, UNE UNION — MODÈLE G							
W632PG	¾	½	3	1	3 15/16	2¼	1⅝
W633PG	¾	¾	3	1	3 15/16	2¼	1⅝
W634PG	1	1	3½	1⅛	3 15/16	2¼	1⅞
DROIT, DEUX UNIONS — MODÈLE GU							
W642PGU	¾	½	3	1	3 15/16	2¼	2 11/16
W643PGU	¾	¾	3	1	3 15/16	2¼	2 11/16
W644PGU	1	1	3½	1⅛	3 15/16	2¼	2 13/16

PURGEURS THERMOSTATIQUES WEBSTER

Série 7 pour applications à basse pression

Le purgeur thermostatique Webster Série 7 est du type à diaphragme et conçu pour la vapeur à basse pression et le chauffage à vapeur par le vide. La pression de marche maximum recommandée est de 15 livres au pouce carré, bien que de plus hautes pressions puissent occasionnellement être tolérées. Ce purgeur est recommandé pour tous types de radiateurs, points d'égouttement, machinerie à vapeur et autres applications dans l'ordre de sa pression et de son rendement.

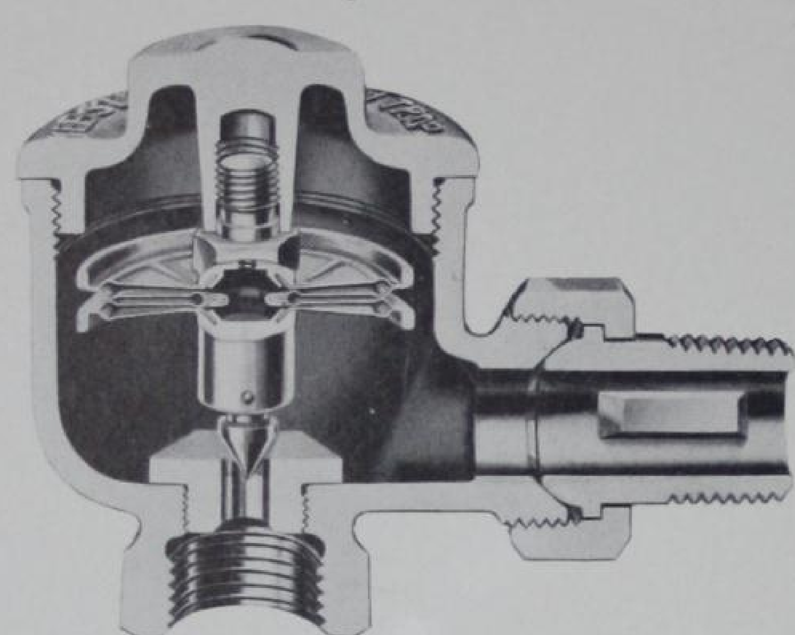


Fig. 2 — Purgeur thermostatique Webster 702H.

Compensé pour toutes pressions

Avec le purgeur Webster Série 7, la vapeur est retenue dans le radiateur jusqu'à ce qu'elle ait transmise sa chaleur utile. Ce purgeur ne s'ouvre pas trop tôt pour gaspiller la vapeur dans les conduites de retour, pas plus qu'il ne se ferme trop vite pour retenir la condensation et abaisser le rendement du radiateur. L'eau de condensation, l'air et les autres gaz sont entièrement et continuellement évacués, que la pression à l'intérieur du radiateur soit de 15 livres, soit sous un faible vide ou à toute autre pression intermédiaire. Ceci s'accomplit en *compensant pour la variation de la pression,* une particularité de tous les purgeurs thermostatiques Webster.

Fabrication de haute qualité

L'élément thermostatique du purgeur Webster Série 7 est composé d'un robuste diaphragme double en métal monel—métal non corrosif qui conserve son "élasticité" dans des conditions de température et de pression très variées. A remarquer dans l'illustration que les joints du diaphragme sont à triple étanchéité, c'est-à-dire, étamés, enroulés et soudés. Les nervures concourent à la résistance structurale. Le pointeau de cuivre est réglé en permanence. Sa conicité de 60° fournit une fermeture sûre et étanche. Tout opérateur expérimenté connaît la valeur de ce modèle pour conserver un chauffage libre de toute interruption causée par la saleté.

Le corps et le chapeau sont en cuivre de haute qualité pour la vapeur. Les surfaces usinées métal contre métal assurent des joints étanches. Le siège à bord aigu est en cuivre; il est fileté pour en faciliter le remplacement. L'écrou et le mamelon de l'union sont en cuivre et possèdent toute la robustesse voulue pour soutenir les rudes traitements de la pose.

Une fois assemblé, chaque purgeur est éprouvé à l'eau chaude et à la vapeur. Aucun purgeur ne sort de nos usines sans avoir subi tous les examens et essais et démontré un fonctionnement parfait.

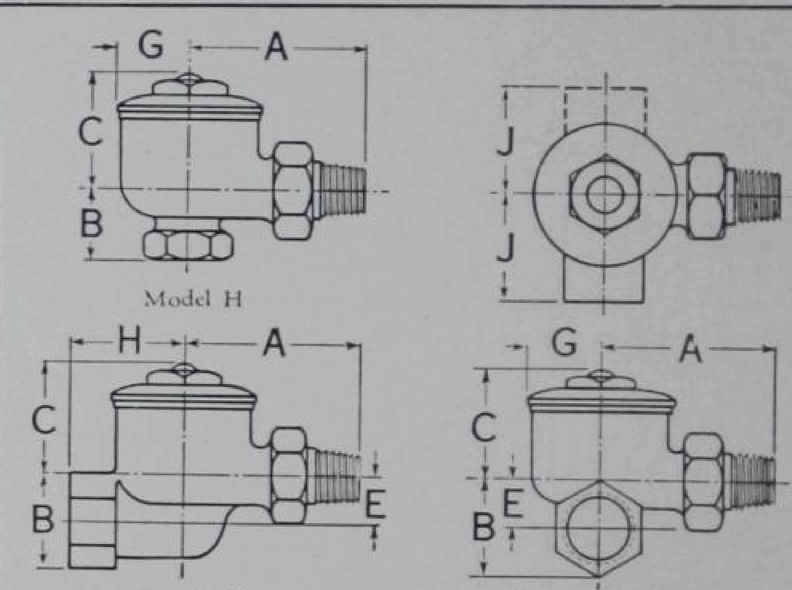
Série 7M pour pressions moyennes

Le purgeur Webster Série 7M, livré avec pointeau et siège en acier inoxydable, est recommandé pour des pressions de marche jusqu'à 25 livres au pouce carré, et occasionnellement jusqu'à 50 livres au pouce carré. Sous tous autres rapports, le purgeur Série 7M est identique à celui de la Série 7.

Table III. Capacités recommandées en pieds carrés de chauffage direct équivalent (E.D.R.)*

Symbole	Dia.	Différence de pression de l'entrée à la sortie du purgeur, en livres au pouce carré							
		¼	½	1	1½	2	5	10	15
702	½	85	120	165	200	235	370	530	640
713	¾	165	230	330	400	465	730	1050	1300
724	1	290	410	580	700	810	1280	1840	2300

*Données basées sur 240 B.t.u. (unités thermiques britanniques) au pied carré à l'heure. Les capacités sont conformes aux standards recommandés et adoptés par la Steam Heating Equipment Manufacturers Association. Choisissez le purgeur directement de la table ci-dessus, pour le plus bas différentiel qui puisse exister dans le système.



Dimensions du purgeur Série 7. D'équerre (H), droit (G), modèles pour la droite (R) et la gauche (L).

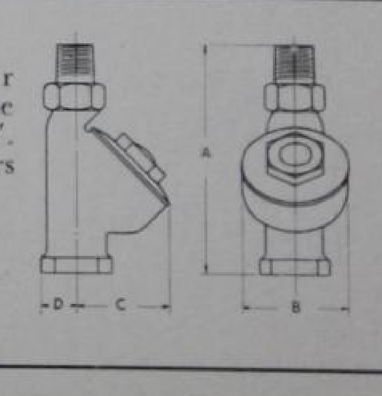
Table IV. Dimensions du purgeur Série 7. Modèles H. G. R. et L.

Dia.	Symbcle	Modèle	A	B	C	E	G	H	J
½	702	H	2¾	1⅛	1 13/16		1 3/16		
½	702	G	2¾	1½	1 13/16	¾		1 13/16	
½	702	R & L	2¾	1½	1 13/16	¾	1 3/16		1⅝
¾	713	H	3 9/16	1 7/16	1 11/16		1⅝		
¾	713	G	3 9/16	1 11/16	1 11/16	¾		2¼	
1	724	H	4¼	1 13/16	2 3/16		1⅞		

Toutes les dimensions sont en pouces et sujettes à de légères variations.

Dimensions du purgeur 702V, modèle vertical, à une union, entrée ½", sortie ½". Pour radiateurs convecteurs et autres applications.

A—5" C—2"
B—2 5/16" D—¾"



PURGEUR D'ÉGOUTTEMENT THERMOSTATIQUE ET À FLOTTEUR WEBSTER

Pressions de marche: jusqu'à 15 livres au pouce carré

SÉRIE 26-T: Purgeur à grand rendement, capable d'évacuer de forts volumes de condensation et d'air. Compact et léger. Approprié pour égouttement de conduites principales, pour serpentins de climatisateurs, pour générateurs d'eau chaude, pour divers types de chauffage par radiateurs motorisés ou à évantails, et autres applications similaires. Orifice de sortie latérale. Les grandeurs les plus employées (00026, 0026, 026) comprennent la soupape d'évacuation à orifice externe—qui permet à la soupape de s'ouvrir lorsque de fortes pressions règnent et empêchent ainsi la tuyauterie ou la machinerie de s'emplir d'eau.

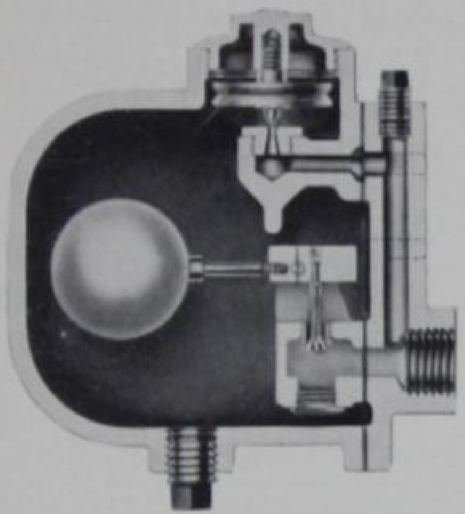


Fig. 3 — Purgeur d'égouttement Webster à grand rendement, grandeur 00026-T.

Particularités de fabrication: Pointeau et siège en cuivre sur la sortie d'eau. Le diaphragme thermostatique pour l'air est en métal monel avec pointeau et siège en cuivre. Les autres pièces intérieures sont en laiton, en cuivre ou en fer. Le corps et le couvercle sont en fonte.

La grandeur 00026 a un orifice d'entrée et un de sortie dans le couvercle. Un choix de deux orifices d'entrée sur les parois opposées du corps et de deux orifices de sortie au fond est offert sur les grandeurs 0026 et 026. Des bouchons mâles sont livrés pour une entrée et une sortie. Ces grandeurs peuvent être montées sur la canalisation sans l'aide d'aucun support.

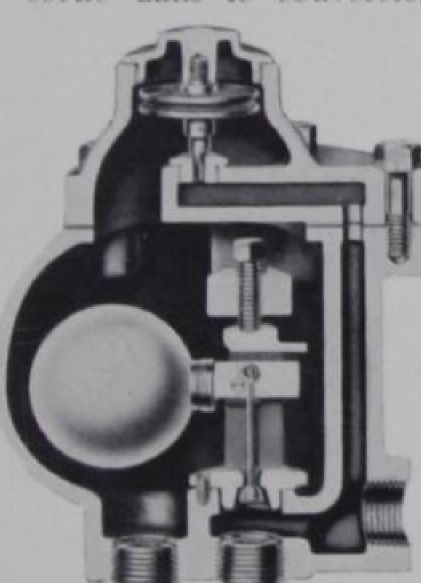


Fig. 4 — Purgeur d'égouttement Webster à grand rendement, grandeur 0026-T. Le 026-T est semblable sauf que l'intérieur du flotteur est boulonné au lieu d'être agrafé.

Les grandeurs 126 et 226 ont un seul orifice d'entrée et de sortie dans le bout et doivent être installées avec un support. Un gros flotteur et un long levier fournissent amplement de puissance pour le fonctionnement de la soupape s'ouvrant intérieurement.

SÉRIE 26-0: Ce purgeur est semblable au 26-T, mais possède un couvercle uni au lieu d'un couvercle comprenant l'élément thermostatique et le by-pass. Il s'emploie où il n'y a pas de concentration d'air, comme dans les bouts de conduites principales et de tuyaux de montée, sur les réservoirs d'échappement de vapeur et pour l'égouttement des chauffages par gravité dans les conduites de retour par le vide. Il est préparé pour un by-pass d'air externe.

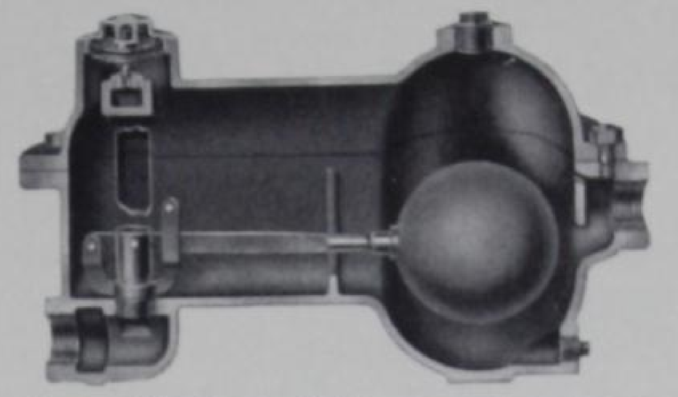
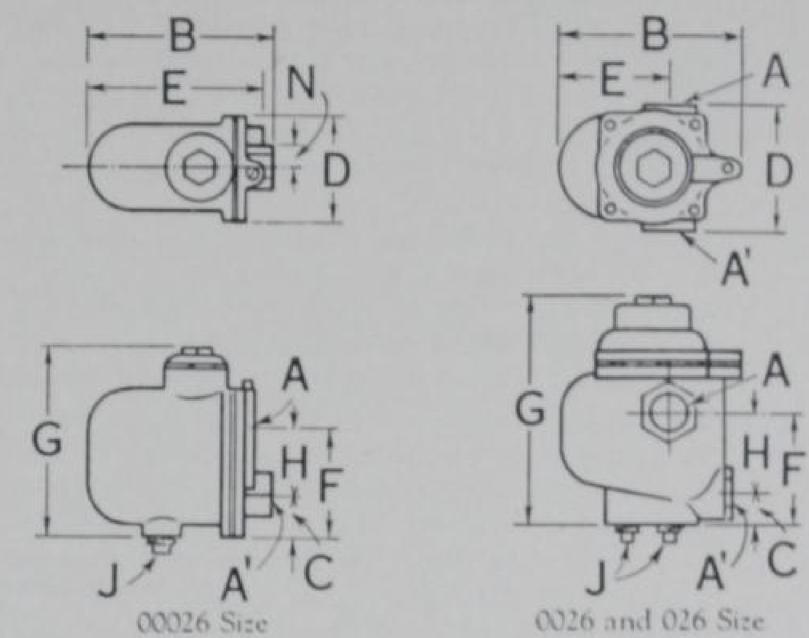
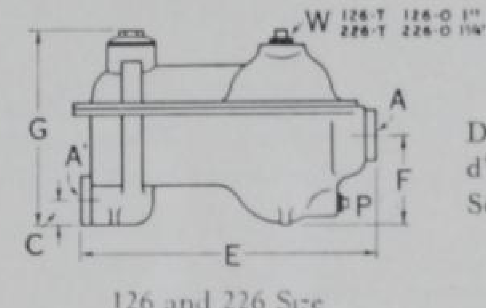


Fig. 5 — Purgeur d'égouttement Webster à grand rendement, grandeur 126-T. Le 226-T est semblable.





Dimensions des purgeurs d'égouttement Webster Série 26.

Table V. Dimensions des purgeurs d'égouttement Webster Série 26

Symbole	A	B	C	D	E	F	G	H	J ou P	Poids net Livres
00026-T	3/4	6 5/8	1 1/2	3 3/4	6 1/8	3 7/8	6 5/8	2 3/8	1/2	10
00026-O	3/4	6 5/8	1 1/2	3 3/4	6 1/8	3 7/8	6 5/8	2 3/8	1/2	10 1/4
0026-T	1	6 5/8	1 1/8	4 1/2	3 13/16	3 13/16	8 5/8	2 13/16	1	13 1/4
0026-O	1	6 5/8	1 1/8	4 1/2	3 13/16	3 13/16	7 1/16	2 13/16	1	12 1/4
026-T	1 1/4	8 3/16	2 1/2	5 1/8	4 7/8	5 5/8	10 1/2	3 1/8	1 1/4	19
026-O	1 1/4	8 3/16	2 1/2	5 1/8	4 7/8	5 5/8	8 7/16	3 1/8	1 1/4	17 1/2
126-T	1 1/2	......	1 3/8	......	15	4 5/8	10 1/2	......	1/2	45
126-O	1 1/2	......	1 3/8	......	15	4 5/8	9	......	1/2	38
226-T	2	......	1 5/8	......	18 3/8	5 1/2	12	......	1/2	62
226-O	2	......	1 5/8	......	18 3/8	5 1/2	11 3/8	......	1/2	55

La dimension N est de 3/4" sur le 00026.

Toutes les dimensions sont en pouces et sujettes à de légères variations.

Table VI. Capacités recommandées pour les purgeurs d'égouttement thermostatiques et à flotteur Webster, en livres d'eau à l'heure.

Pouces Dia.	Symbole	Différence de pression de l'entrée à la sortie du purgeur, en livres au pouce carré								
		1/8	1/4	1/2	3/4	1	2	5	10	15
3/4	00026-T et O	50	70	100	120	140	200	210	220	230
1	0026-T et O	125	175	250	300	350	500	525	550	575
1 1/4	026-T et O	300	425	600	735	850	1200	1260	1320	1380
1 1/2	126-T et O	600	850	1200	1470	1700	2400	2520	2640	2760
2	226-T et O	1250	1775	2500	3060	3550	5000	5250	5500	5750

Facteurs de conversion: Pour changer les données en livres d'eau à l'heure en pieds carrés de chauffage direct équivalent (e.d.r.) à 240 B.t.u., multipliez par 4. Les capacités sont conformes aux standards recommandés et adoptés par la Steam Heating Equipment Manufacturers Association pour l'évacuation continue de l'air lorsque le purgeur fonctionne à sa capacité maximum.

Webster **MATÉRIEL DE CHAUFFAGE**

SÉPARATEURS DE SÉDIMENTS EN "Y" DARLING

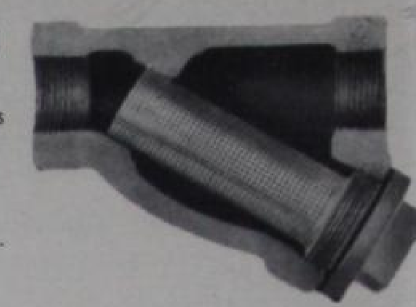
Les écailles de tuyau, les morceaux de garniture et autres matières étrangères sont souvent la cause de dommage aux purgeurs à vapeur, aux réducteurs de pression, aux régulateurs de température, etc. Leur fonctionnement médiocre et parfois leur complet arrêt peuvent souvent remonter à des sédiments dans les canalisations. Il est donc toujours recommandable d'installer un séparateur pour protéger ces appareils.

Les séparateurs de sédiments Darling Série 29 sont construits de façon à ne pas réduire le volume de fluide qui les traverse. Le filtre est placé avec un bout ouvert sur l'entrée et l'autre bout ouvert pour la vidange. Le fluide s'écoule de l'entrée à la sortie en passant au travers du filtre qui retient toute matière étrangère et d'où elle peut ais ment être vidangée.

Ce séparateur de sédiments s'adapte aux conduites horizontales ou verticales avec écoulement en descendant. Dans l'une ou l'autre position, le bouchon de vidange du séparateur doit pointer vers le bas.

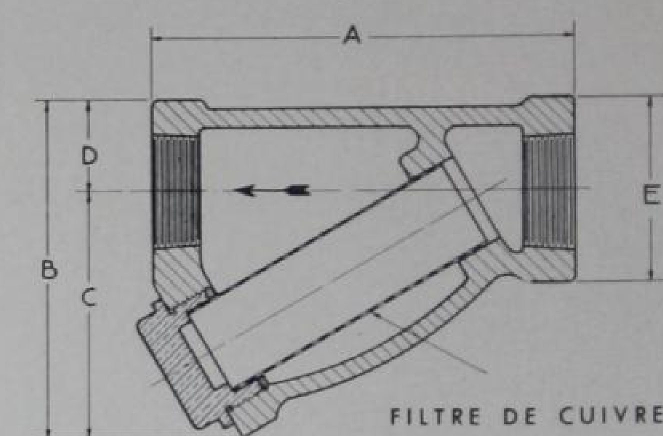
Le corps des séparateurs en "Y" Darling est en fonte avec filtre cylindrique en cuivre dont la superficie des perforations est de plusieurs fois supérieure à celle de la taille du tuyau correspondant. Le séparateur Série 29 est taraudé et offert dans les diamètres de ½" à 2" inclusivement. Les filtres cylindriques réguliers ont 256 perforations de .040 pouce au pouce carré. Des filtres en métal monel peuvent être fournis moyennant majoration. Des filtres fins, fabriqués de toile de cuivre, peuvent être livrés sur demande.

Fig. 6 — Séparateur de sédiments Darling Série 29



Taraudé — pression de marche maximum: 150 livres au pouce carré.

Table VII. Dimensions des séparateurs de sédiments Série 29



Dia. Pouces	Symbole	A	B	C	D	E	Poids
½	292	3⅝	2⅞	2⅛	¾	1½	2
¾	293	4¼	3 7/16	2½	15/16	1⅞	3
1	294	5⅛	4	2 15/16	1 1/16	2⅛	4
1¼	295	5 13/16	4⅝	3⅜	1¼	2½	6
1½	296	6½	5 13/16	3¾	1 7/16	2⅞	8
2	298	8	6 9/16	4⅞	1 11/16	3⅜	13

Toutes les dimensions sont en pouces et sujettes à de légères variations. Le poids s'entend en livres.

AUTRES SPÉCIALITÉS DE CHAUFFAGE WEBSTER

	Bulletin No
Plinthe radiateur Webster à fort rendement	B-1601
Wall Vectors Webster	B-1551
Radiateurs W.I.	B-1550-C
Plinthe radiateur Webster	B-5-CE
Commande d'écoulement continu Webster pour chauffage à eau chaude	B-200
Purgeur à vapeur Webster pour machinerie	1200-H
Joints d'expansion Webster Type "N"	B-1103-B
Joints d'expansion Webster Type "C"	B-1101-B
Protecteur de chaudières Webster	B-727-E
Commandes à modérateur Webster E-5	B-9004-A

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SAINT JOHN, N.B.
E. S. Stephenson & Co., Ltd. .... 15 Dock Street

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W. J. Banks .... 140 St. John Street

ARVIDA, P.Q.
René Beaudet & Cie Ltée .... 122 High Street

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Patricia Engineering Ltd. .... 46½ Third Ave.

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Darling Brothers Limited .... 18 Rideau Street

TORONTO, ONT.
Darling Brothers Limited .... 137 Wellington St. W.

WINNIPEG, MAN.
Darling Brothers Limited .... 123 Princess Street

CALGARY, ALTA.
H. F. Clarke & Co. Ltd. .... 1114 Fifth St. W.

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SIÈGE SOCIAL ET USINES

DARLING BROTHERS LIMITED

140 PRINCE ST. MONTREAL, CANADA

DEPUIS 1888

DARLING

STRAINERS AND FILTERS

"Y" TYPE STRAINERS

Pipe scale, sediment, bits of packing, and other foreign matter is often the cause of damage to pressure reducing valves, temperature regulators, steam traps, etc. and unsatisfactory operation or even complete failure can frequently be attributed to pipe line impurities. Therefore, the installation of a strainer is always recommended to protect such equipment.

Darling Series 29 and Series 30 Strainers are so constructed that they do not reduce the volume of fluid passing through them. The screen is placed with one end open to the inlet port and the other end open to the blow off. The flow passes from inlet to outlet port through the screen so that all foreign matter is trapped in the cylinder, from where it is readily removed.

Adaptable to both horizontal and vertical downward flow pipe lines. In either position these strainers must be installed with the cap down.

Darling "Y" type Strainers have cast iron bodies with perforated brass strainer cylinders, area of which are several times larger than corresponding pipe sizes. Series 29 are screwed pattern made in sizes ½" to 3" inclusive. Series 30 flanged pattern are made in sizes 2½" to 6" inclusive and in two weights, standard for pressures up to 150 lbs. per sq. in. and extra heavy for pressures up to 250 lbs. per sq. in. Standard cylinder screens have .040 inch diameter perforations 225 holes to the sq. in. Screens of monel metal can be supplied at extra charge. Fine mesh screens made of brass wire cloth can be furnished when specified.

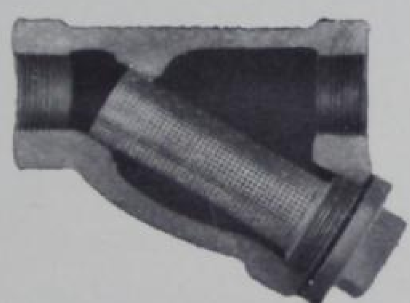
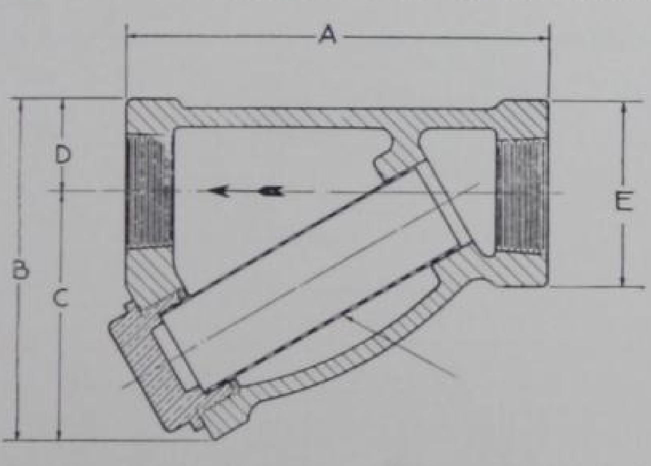


Fig. 1. Darling Series 29 Dirt Strainers.
Screwed Pattern—maximum working pressure 150 lbs. per sq. in.

TABLE I — Dimensions of Series 29 Dirt Strainers.

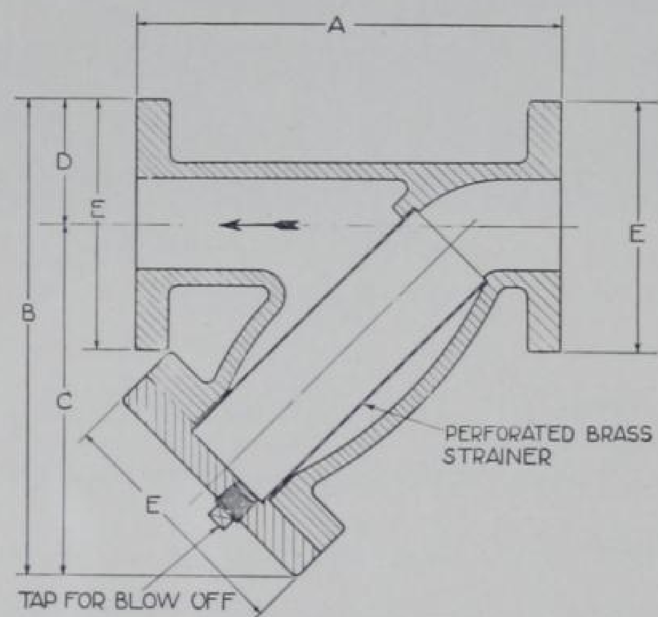


Size Inches	Symbol	A	B	C	D	E	Weight
1/2	292	3 5/8	2 7/8	2 1/8	3/4	1 1/2	2
3/4	293	4 1/4	3 7/16	2 1/2	15/16	1 7/8	3
1	294	5 1/8	4	2 15/16	1 1/16	2 1/8	4
1 1/4	295	5 13/16	4 5/8	3 3/8	1 1/4	2 1/2	6
1 1/2	296	6 1/2	5 13/16	3 3/4	1 7/16	2 7/8	8
2	298	8	6 9/16	4 7/8	1 11/16	3 3/8	13
2 1/2	2910	9 3/4	7 15/16	5 3/4	2 3/16	4 3/8	22
3	2912	11 1/4	9 1/4	6 3/4	2 1/2	5	36

All dimensions in inches and subject to slight variations. Weight in pounds.

Fig. 2. Darling Series 30 Dirt Strainers.
Standard flanged pattern—maximum working pressure 150 lbs. per sq. in. Extra heavy flanged pattern—maximum working pressure 250 lbs. per sq. in.

TABLE II — Dimensions of Series 30 Dirt Strainers.



Standard Pattern

Size Inches	Symbol	A	B	C	D	E	Weight
2 1/2	3010	13	14 1/4	10 3/4	3 1/2	7	70
3	3012	14	15	11 1/4	3 3/4	7 1/2	80
4	3016	16 1/2	18 1/4	13 3/4	4 1/2	9	170
5	3020	18 5/8	20 1/8	15 1/8	5	10	190
6	3024	20 3/4	22 1/8	16 5/8	5 1/2	11	250

Extra Heavy Pattern

Size Inches	Symbol	A	B	C	D	E	Weight
2 1/2	3010	13	14 5/8	10 7/8	3 3/4	7 1/2	80
3	3012	14	15 5/8	11 1/2	4 1/8	8 1/4	100
4	3016	16 1/2	19	14	5	10	180
5	3020	18 5/8	21	15 1/2	5 1/2	11	220
6	3024	20 3/4	23 3/8	17 1/8	6 1/4	12 1/2	280

All dimensions in inches and subject to slight variations. Weight in pounds.

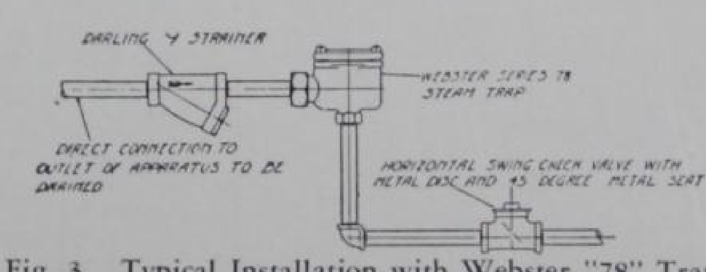


Fig. 3. Typical Installation with Webster "78" Trap.

TYPE "D" DUPLEX STRAINERS

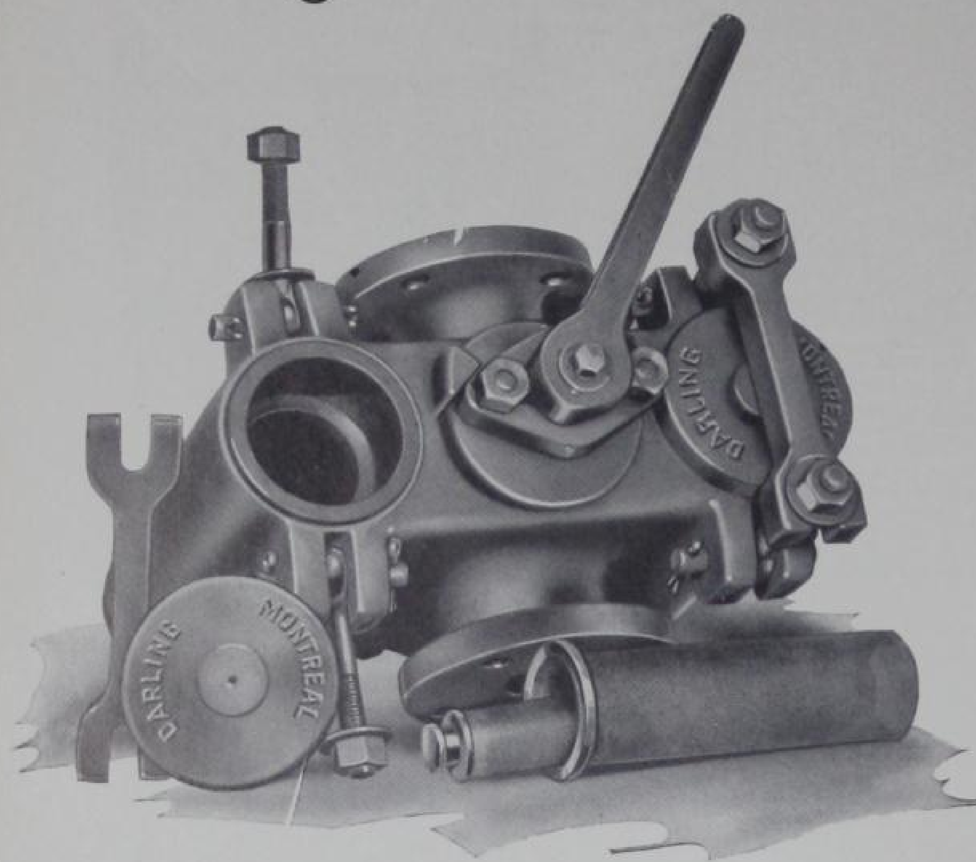


Fig. 4. Duplex Strainer.

This duplex strainer has a wide application in many industries, but is particularly suited to Fuel Oil Burning installations.

The principal advantages of Darling Type "D" Duplex Strainers are as follows:

No valves — a 90-degree turn of the handles changes from one to the other basket.

Positive adjustment of tapered plug valve by means of jack screw.

Strainer basket being in two parts is more readily cleaned.

Double basket (the combined area of whose perforations is from six to ten times the cross sectional area of the pipe and about twice the area of other makes of strainers).

Designed so that when well cover is removed level of liquid in well is lowered, exposing the top of basket for removal. Tongue and Groove joints on well covers.

Handle partially covers basket-well which is in use, leaving exposed the well which is out of commission and free to be cleaned. In no position of handle is it possible to stop the flow.

Elimination of the many joints necessary in a duplex strainer made up with valves.

Maximum working pressure 100 lbs. Available in cast steel for pressures over 100 lbs.

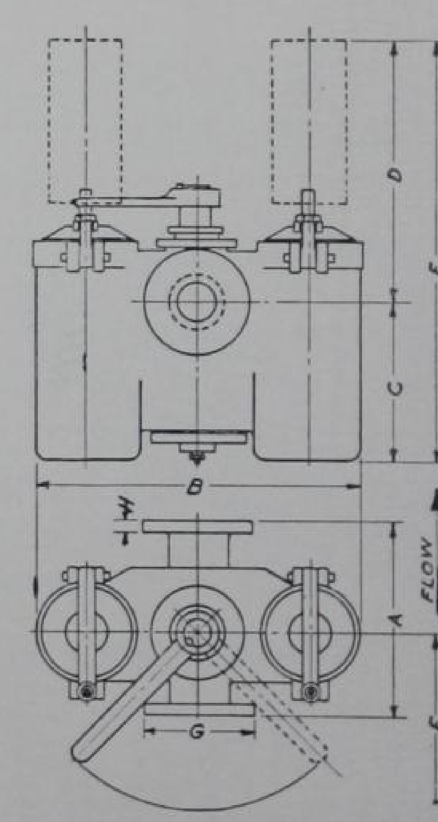
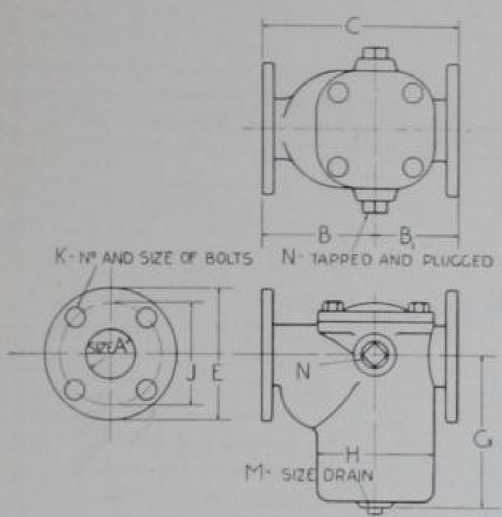


TABLE III

Size	A Std. Flange	A Ext. Heavy Flange	B	C	D
1½"	8¾"	9¼"	12"	7½"	10"
2"	10⅜"	10⅞"	16"	8"	12"
2½"	12"	12⅝"	18"	10"	13½"
3"	13"	13¾"	19"	12"	17"

WEBSTER SUCTION STRAINERS



Size A	B	B₁	C	E	G	H
2	5⅜	4	9⅜	6	6⅞	5¼
3	6⅛	4⅞	11	7½	8⅞	5¾
4	8½	5⅜	13⅞	9	10⅝	7⅛
5	9⅜	6⅛	15½	10	12⅛	8¼
6	10⅜	7	17⅜	11	13¾	9⅝
8	14⅛	9⅞	24	13½	21	14½
10	17¼	11¼	28½	16	24⅞	16¾
12	21	12⅞	33⅞	19	29	20

Size A	J	K	M	N
2	4¾	4–⅝x2	½	¾
3	6	4–⅝x2¼	½	¾
4	7½	8–⅝x2¾	½	¾
5	8½	8–¾x2¼	½	¾
6	9½	8–¾x2¼	½	¾
8	11¾	8–¾x3⅛	¾	1
10	14¼	12–⅞x3½	¾	1
12	17	12–⅞x3½	¾	1

TABLE IV — Dimensions of Webster Suction Strainers.

Installed ahead of vacuum pump to prevent dirt and scale, brought down with condensation from heating system, from damaging pump with resultant troubles.

A tapping is provided for introduction of cold water makeup when that is desired; another for connection to a vacuum gauge. Made of heavy cast iron with flanged connections. Companion flanges are extra equipment. Cleanout cover is bolted on with rubber gasket joint. Screen basket is made of sheet brass with No. 4 holes (.045 in. dia.), 225 holes per sq. in. and is easily removable for cleaning. Maximum working pressure, 15 lbs. per sq. in.

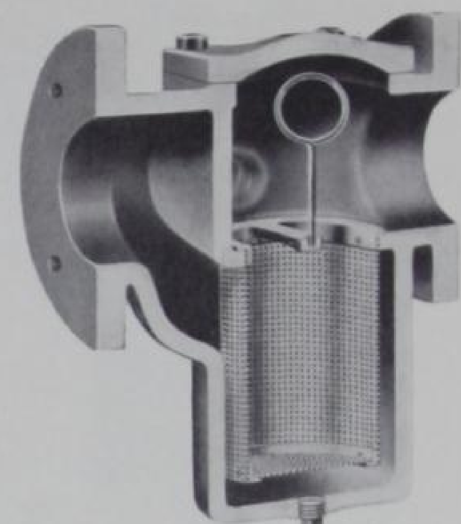


Fig. 5. Webster Suction Strainers.

DARLING TYPE "W" DUPLEX SUCTION STRAINERS

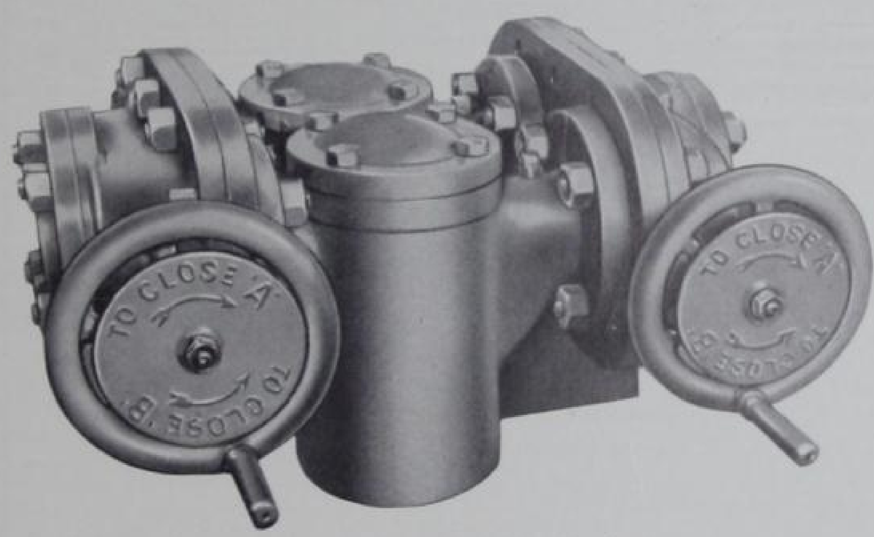


Fig. 6. Darling Duplex Strainers.

The principal advantages of the duplex suction strainer is where continuous operation is required; it is possible to shut off one strainer and use the other, permitting the first one to be cleaned and made ready in a few moments for future use.

Of rugged design, it is a dependable unit and often used in suction lines from oil tanks and other special applications.

Made in sizes from 4" to 8".

Companion flanges included as part of the unit.

Maximum working pressure 15 lbs. per sq. in.

TABLE V — Dimensions of Darling Duplex Strainers.

Size	Face to Face	Overall Width	Overall Height	Extra space for strainer removal	Weight
4	24	28	16⅝	14⅝	600
5	28⅛	32¼	19⅞	14¼	790
6	30	34	21½	15¼	950

DARLING WATER SUPPLY FILTERS

An adaptation of the Darling Feed water filter shown on page 4. The filtering media is Linen Terry (Turkish towelling). The body is of welded steel construction. This filter is recommended for use on water supply systems where it is necessary to remove suspended matter. Spare filter cartridges are available which will facilitate the servicing of these units.

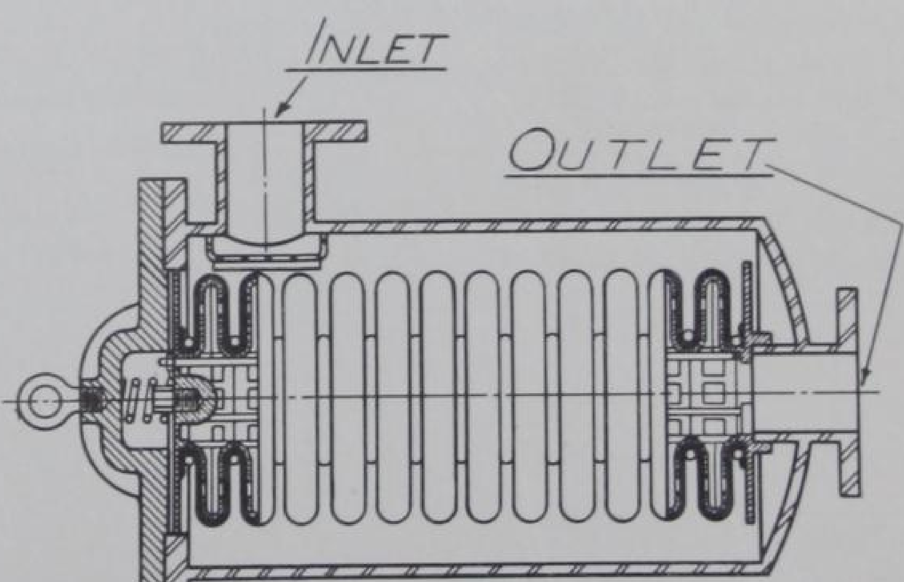


Fig. 7.

FEED WATER FILTERS

Fig. 8. Darling Feed Water Filter.

Darling Feed Water Filters are suitable for water pressures up to 250 lbs.

Fig. 8 shows exterior view of the larger sizes No. 5, 6 and 7. The interior of filter is same as shown in Fig. 11.

These illustrations show the Darling Feed Water Filter. Its function is to remove oil from boiler feed water. The filter is usually connected between the feed pump and the boiler. Single or duplex types can be supplied.

Fig. 9 illustrates assembly and compact arrangement of control valves of No. 1, 2, 3 and 4 sizes of filter, to permit by-passing when changing filtering media; this valve arrangement is furnished as an extra only.

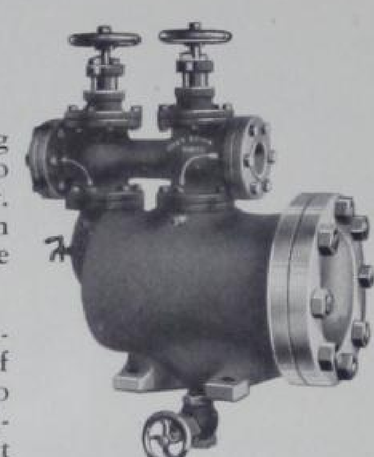


Fig. 9. Darling Feed Water Filter with manifold.

By reference to the sectional illustration Fig. 11 the operation of the filter will be readily understood. The water enters at the top and passes into the central portion of the chamber which is occupied by the filter cartridge which extends horizontally the entire length. Note Blow-off for cleaning filter body.

The filtering material employed is what is familiarly known as Linen Terry (Turkish towelling) of fine quality. This can be cleaned several times. New towelling can be had at reasonable price.

It presents a very large filtering area, having at least 150 times the area of the feed pipe.

In connecting the filter a by-pass should be provided so that the same may be cleaned and fresh filter cartridge inserted without shutting down the plant. An extra filter cartridge is supplied with each filter.

Fig. 10.

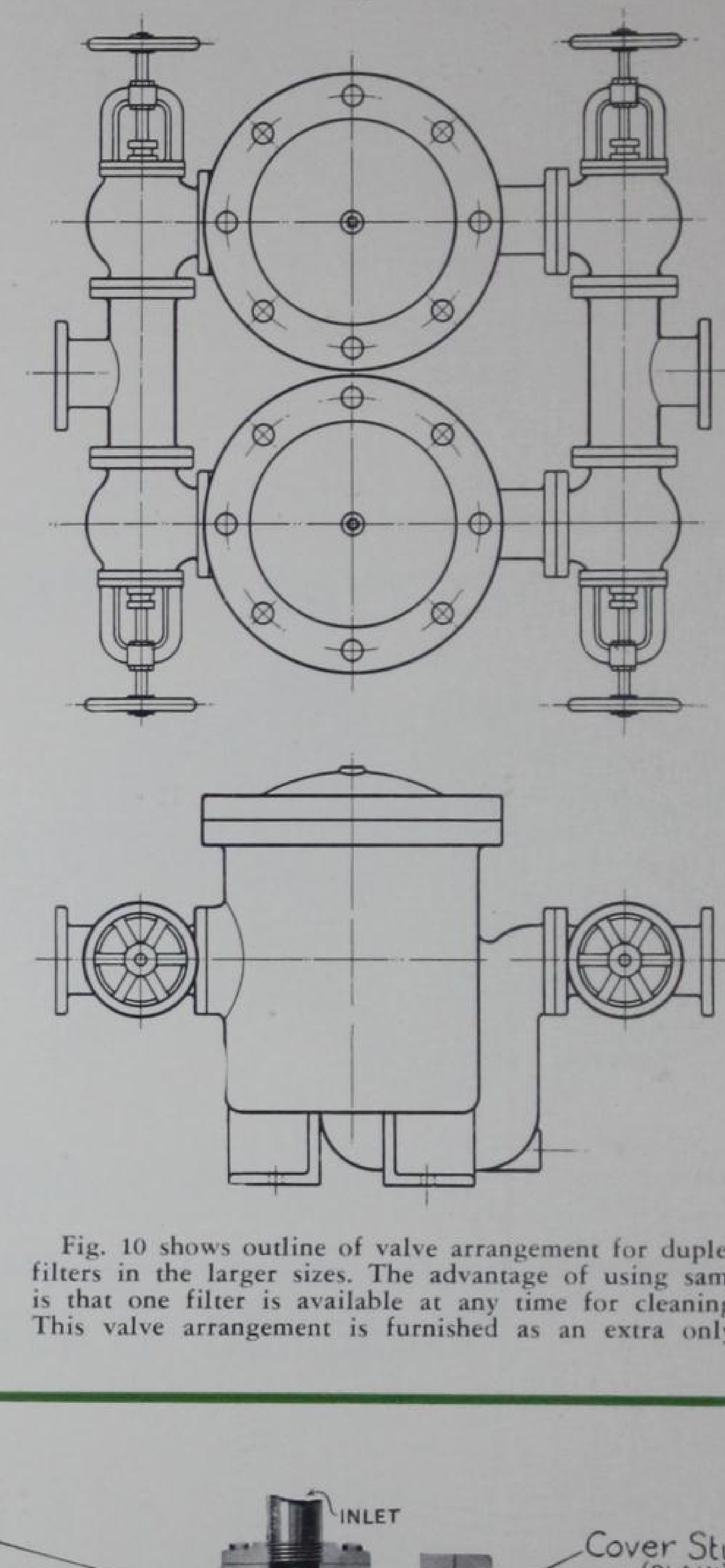


Fig. 10 shows outline of valve arrangement for duplex filters in the larger sizes. The advantage of using same is that one filter is available at any time for cleaning. This valve arrangement is furnished as an extra only.

TABLE VI — Capacity Darling Feed Water Filters.

No.	Size	Weight	Capacity Lbs. per hour
1	1	170	7,000
2	1½	190	10,000
3	2	340	17,000
4	2½	360	28,000
5	3	600	38,000
6	3½	650	50,000
7	4	800	65,000

By-Passing Manifold furnished at extra price only.

Sizes 1, 2, 3, 4 are horizontal pattern.

Sizes 5, 6, 7 are vertical pattern.

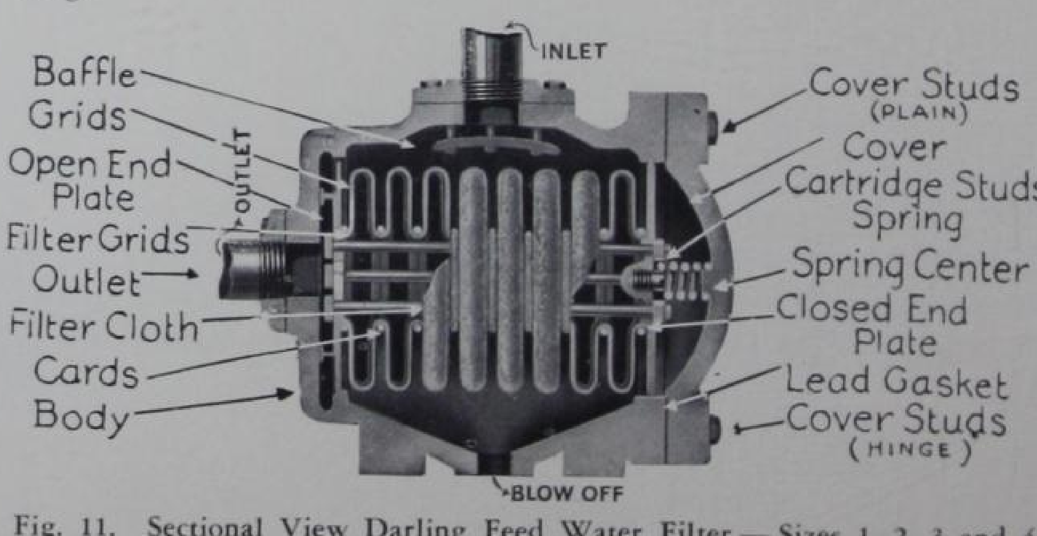


Fig. 11. Sectional View Darling Feed Water Filter — Sizes 1, 2, 3 and 4.

DARLING

SÉPARATEURS ET FILTRES

Séparateurs de sédiments en "Y"

Les écailles de tuyau, les morceaux de garniture et autres matières étrangères sont souvent la cause de dommage aux purgeurs à vapeur, aux réducteurs de pression, aux régulateurs de température, etc. Leur fonctionnement médiocre et parfois leur complet arrêt peuvent souvent remonter à des sédiments dans les canalisations. Il est donc toujours recommandable d'installer un séparateur de sédiments pour protéger ces appareils.

Les séparateurs de sédiments Darling Série 29 et Série 30 sont construits de façon à ne pas réduire le volume de fluide qui les traverse. Le filtre est placé avec un bout ouvert sur l'entrée et l'autre bout ouvert pour la vidange. Le fluide s'écoule de l'entrée à la sortie en passant au travers du filtre qui retient toute matière étrangère dans son cylindre, et d'où elle peut aisément être vidangée.

Ce séparateur de sédiments s'adapte aux conduites horizontales ou verticales avec écoulement en descendant. Dans l'une ou l'autre position, le bouchon de vidange du séparateur doit pointer vers le bas.

Le corps des séparateurs en "Y" Darling est en fonte avec filtre cylindrique en cuivre, dont la superficie des perforations est de plusieurs fois supérieure à celle de la taille du tuyau correspondant. Le séparateur Série 29 est taraudé et offert dans les diamètres de 1/2" à 3" inclusivement. Celui de la Série 30, à brides, est présenté dans les diamètres de 2 1/2" à 6" inclusivement et en deux types: série normale pour pressions jusqu'à 150 livres au pouce carré et série extra-lourde pour pressions jusqu'à 250 livres au pouce carré. Les filtres cylindriques réguliers ont 225 perforations de .040 pouce au pouce carré. Des filtres en métal monel peuvent être fournis moyennant majoration. Des filtres fins, fabriqués de toile de cuivre, peuvent être livrés sur demande.

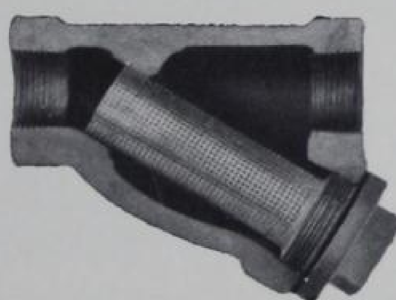
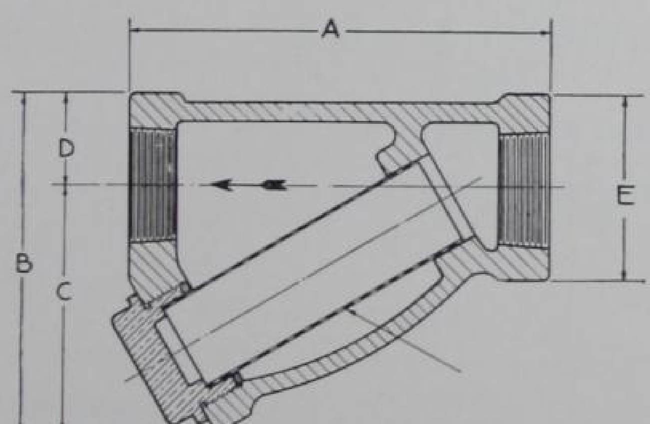


Fig. 1—Séparateur de sédiments Darling Série 29.
Taraudé—pression de marche maximum: 150 livres au pouce carré.

TABLE I — Dimensions des séparateurs de sédiments Série 29.

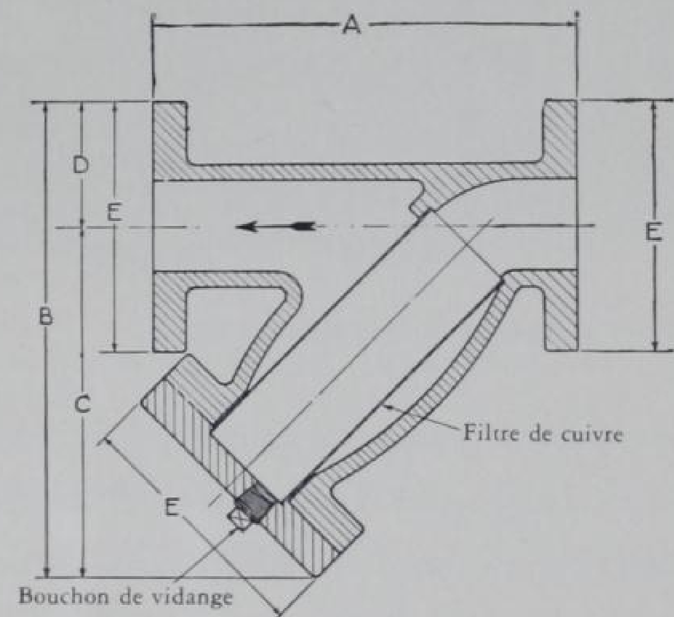


Dia. Pouces	Symbole	A	B	C	D	E	Poids
1/2	292	3 5/8	2 7/8	2 1/8	3/4	1 1/2	2
3/4	293	4 1/4	3 7/16	2 1/2	15/16	1 7/8	3
1	294	5 1/8	4	2 15/16	1 1/16	2 1/8	4
1 1/4	295	5 13/16	4 5/8	3 3/8	1 1/4	2 1/2	6
1 1/2	296	6 1/2	5 13/16	3 3/4	1 7/16	2 7/8	8
2	298	8	6 9/16	4 7/8	1 11/16	3 3/8	13
2 1/2	2910	9 3/4	7 15/16	5 3/4	2 3/16	4 3/8	22
3	2912	11 1/4	9 1/4	6 3/4	2 1/2	5	36

Toutes les dimensions sont en pouces et sujettes à de légères variations. Le poids s'entend en livres.

Fig. 2—Séparateur de sédiments Darling Série 30.
Modèle normal, à brides — pression de marche maximum: 150 livres au pouce carré. Modèle extra-lourd, à brides — pression de marche maximum: 250 livres au pouce carré.

TABLE II — Dimensions des séparateurs de sédiments Série 30.



Modèle normal

Dia. Pouces	Symbole	A	B	C	D	E	Poids
2 1/2	3010	13	14 1/4	10 3/4	3 1/2	7	70
3	3012	14	15	11 1/4	3 3/4	7 1/2	80
4	3016	16 1/2	18 1/4	13 3/4	4 1/2	9	170
5	3020	18 5/8	20 1/8	15 1/8	5	10	190
6	3024	20 3/4	22 1/8	16 5/8	5 1/2	11	250

Modèle extra-lourd

Dia. Pouces	Symbole	A	B	C	D	E	Poids
2 1/2	3010	13	14 5/8	10 7/8	3 3/4	7 1/2	80
3	3012	14	15 5/8	11 1/2	4 1/8	8 1/4	100
4	3016	16 1/2	19	14	5	10	180
5	3020	18 5/8	21	15 1/2	5 1/2	11	220
6	3024	20 3/4	23 3/8	17 1/8	6 1/4	12 1/2	280

Toutes les dimensions sont en pouces et sujettes à de légères variations. Le poids s'entend en livres.

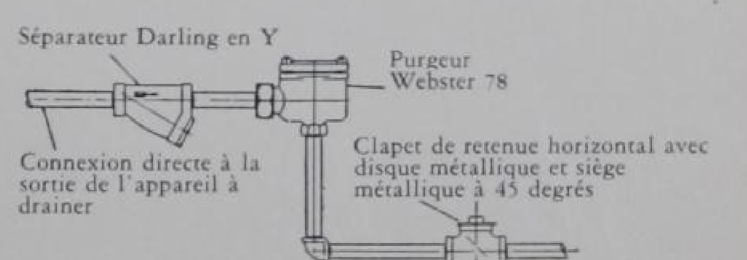


Fig. 3 Installation typique avec purgeur Webster "78".

Séparateurs de sédiments doubles, type "D"

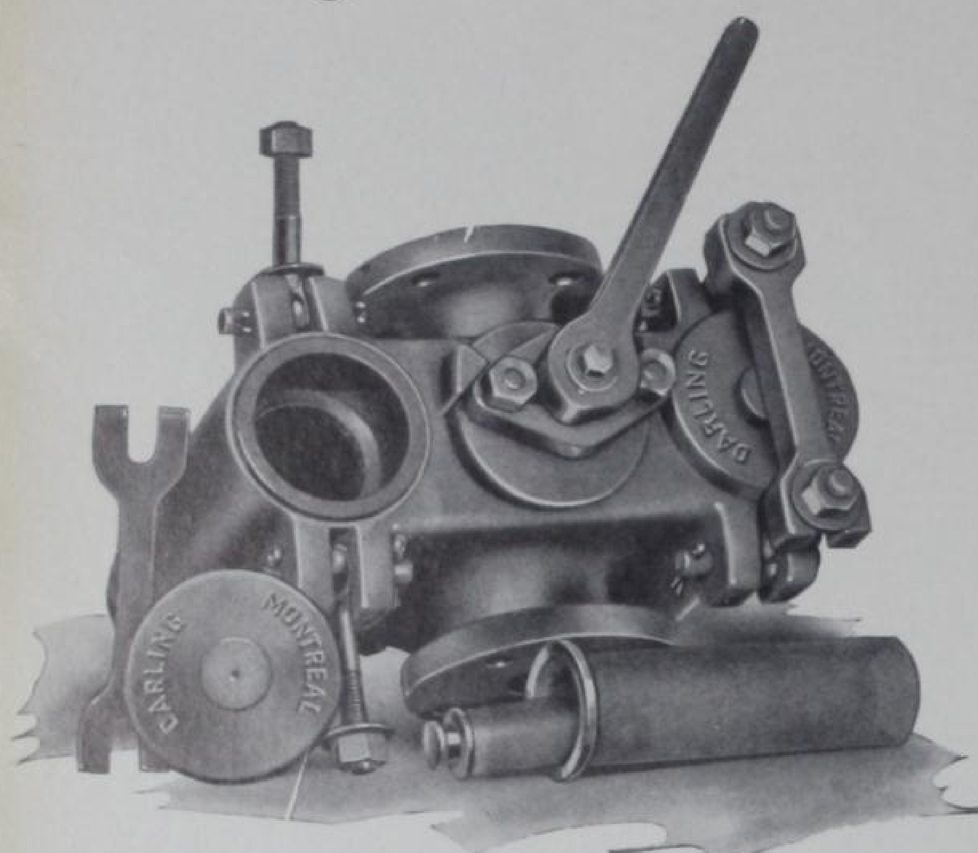


Fig. 4 — Séparateur de sédiments double.

Ce séparateur de sédiments double possède de nombreuses applications industrielles, mais il est particulièrement approprié pour les installations de brûleurs à l'huile.

Les principaux avantages du séparateur double Darling type "D" sont les suivants:

Aucune soupape — un tour de clé de 90° fait passer le liquide d'un filtre à l'autre.

Réglage sûr du boisseau par un vérin à vis.

Le filtre en deux morceaux rend le nettoyage plus facile.

TABLE III

Dia.	A Brides normales	A Brides extra-lourdes	B	C	D
1½″	8¾″	9¼″	12″	7½″	10″
2″	10⅜″	10⅞″	16″	8″	12″
2½″	12″	12⅝″	18″	10″	13½″
3″	13″	13¾″	19″	12″	17″

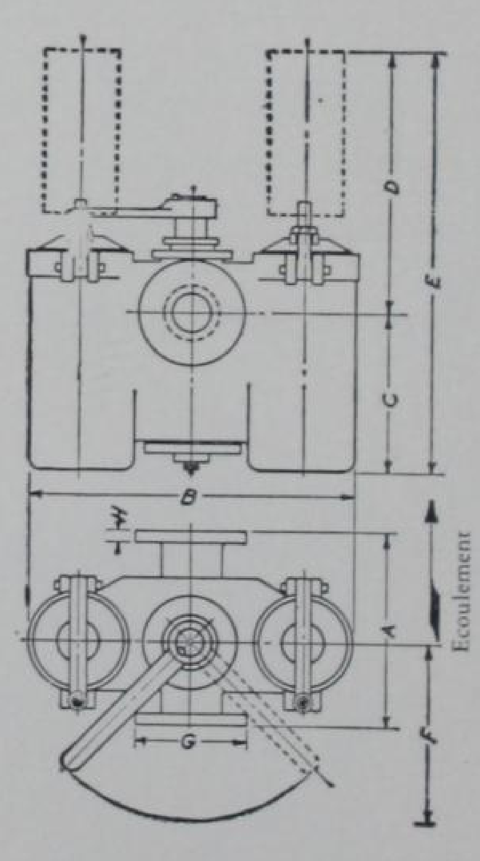
Filtre double (dont la superficie combinée des perforations est de six à dix fois celle de la coupe transversale du tuyau et d'environ deux fois la superficie des autres marques de séparateurs).

Conçu de façon à exposer le dessus du filtre lorsque le couvercle est enlevé. Joint à rainure et languette sur le couvercle.

La clé recouvre partiellement le filtre qui est en usage, laissant à découvert celui à nettoyer. La clé ne peut en aucune position arrêter le liquide.

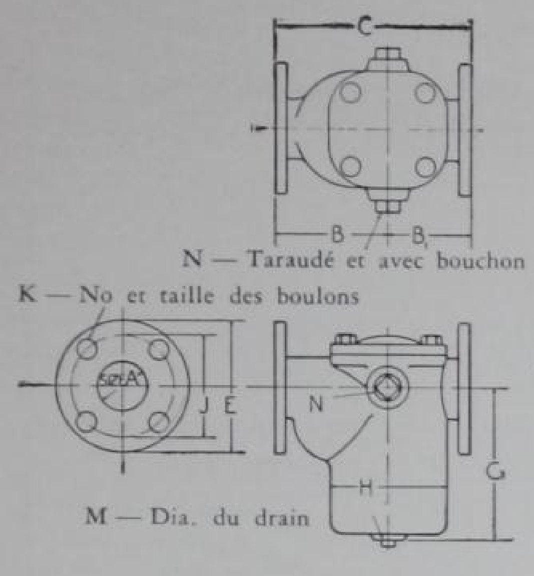
Supression des nombreux joints nécessaires sur les séparateurs doubles fabriqués avec soupapes.

Pression de marche maximum: 100 livres. Offerts en acier coulé pour pressions de plus de 100 livres.



SÉPARATEURS ET FILTRES

Séparateurs Webster à aspiration



Dia. A	B	B₁	C	E	G	H
2	5⅜	4	9⅜	6	6⅞	5¼
3	6⅛	4⅞	11	7½	8⅞	5¾
4	8½	5⅜	13⅞	9	10⅝	7⅛
5	9⅜	6⅛	15½	10	12⅛	8¼
6	10⅜	7	17⅜	11	13¾	9⅝
8	14⅛	9⅞	24	13½	21	14½
10	17¼	11¼	28½	16	24⅞	16¾
12	21	12⅞	33⅞	19	29	20

Dia. A	J	K	M	N
2	4¾	4–⅝x2	½	¾
3	6	4–⅝x2¼	½	¾
4	7½	8–⅝x2¾	½	¾
5	8½	8–¾x2¼	½	¾
6	9½	8–¾x2¼	½	¾
8	11¾	8–¾x3⅛	¾	1
10	14¼	12–⅞x3½	¾	1
12	17	12–⅞x3½	¾	1

TABLE IV — Dimensions des séparateurs de sédiments Webster à aspiration.

Se posent avant la pompe à vide pour empêcher les sédiments et les écailles apportés par la condensation du système de chauffage d'endommager la pompe et pour éviter les ennuis qui s'ensuivraient.

Il y a un orifice taraudé pour refaire le plein d'eau froide au besoin, et un autre pour l'indicateur de vide. Fabriqué en fonte lourde avec connexions à brides. Les contre-brides ne sont pas livrées avec l'appareil. Le couvercle de vidange est boulonné et comporte une rondelle de caoutchouc. Le filtre même est fait de cuivre en feuille avec perforations No 4 (.045 pouce de dia.), 225 trous au pouce carré, et s'enlève facilement pour le nettoyage. Pression de marche maximum: 15 livres au pouce carré.

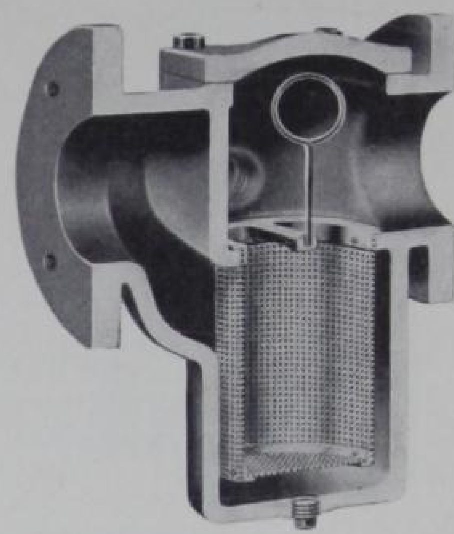


Fig. 5 Séparateur de sédiments Webster à aspiration.

SÉPARATEURS DOUBLES DARLING TYPE "W" À ASPIRATION

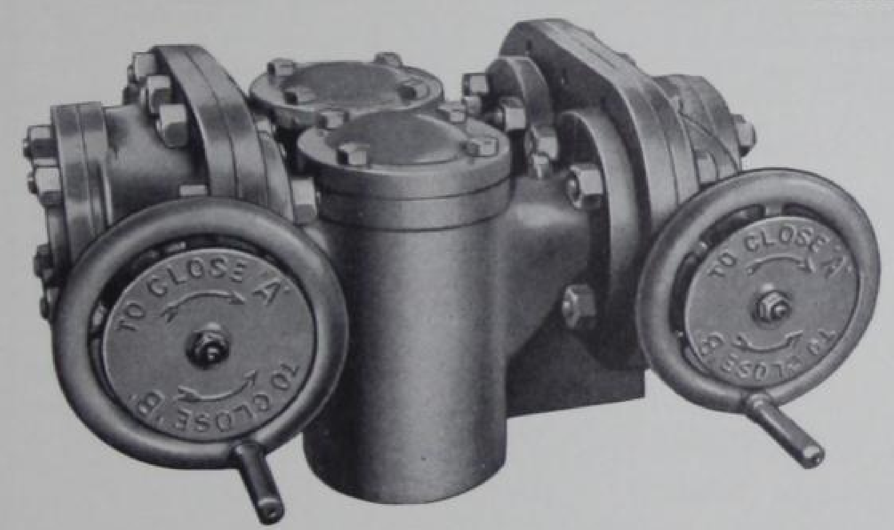


Fig. 6. — Séparateur double Darling.

Ce séparateur offre un avantage particulier là où il ne doit y avoir aucun arrêt dans le fonctionnement: il permet de fermer un filtre et de le nettoyer pendant que le liquide est dirigé vers le deuxième filtre.

De construction robuste, ces séparateurs de sédiments sont sûrs et sont souvent employés sur les conduites des réservoirs d'huile et pour d'autres applications.

Offerts dans les diamètres de 4" à 8".

Les contre-brides sont livrées avec l'appareil.

Pression de marche maximum: 15 livres au pouce carré.

TABLE V — Dimensions des séparateurs doubles Darling.

Dia.	Ecart. des brides	Largeur totale	Hauteur totale	Espace supplé. pour ôter filtre	Poids Livres
4	24	28	16⅝	14⅝	600
5	28⅛	32¼	19⅞	14¼	790
6	30	34	21½	15¼	950

FILTRES DARLING POUR L'ALIMENTATION D'EAU

Ces filtres sont une adaptation du filtre pour l'alimentation d'eau des chaudières illustré à la page 4. Le filtre même est composé de toile bouclée à serviette (serviette turque). Le corps est d'acier soudé. Ce filtre est recommandé pour les systèmes d'alimentation d'eau où il est nécessaire d'enlever les matières en suspension. Des cartouches filtrantes de rechange peuvent être obtenues en vue de faciliter le service.

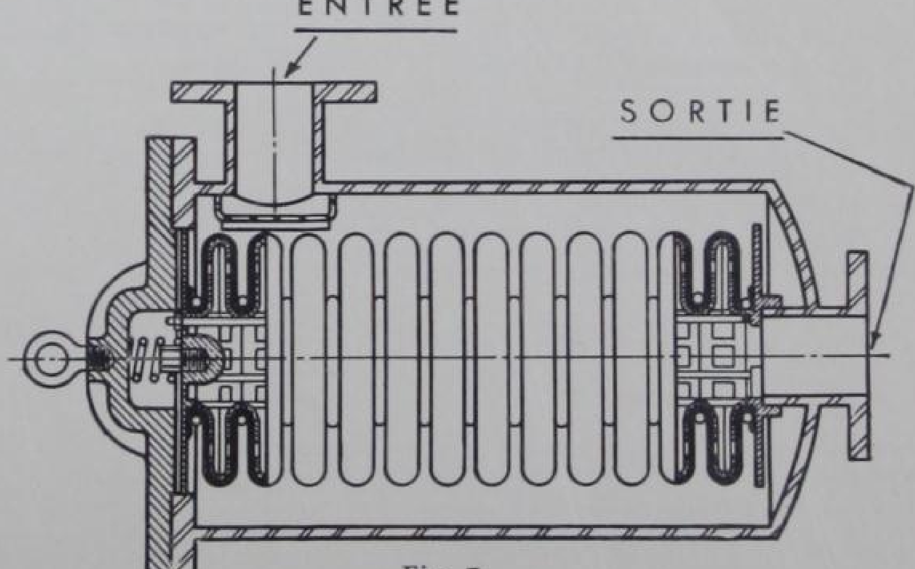


Fig. 7.

SÉPARATEURS ET FILTRES

Filtres pour l'alimentation d'eau des chaudières

Fig. 8 — Filtre Darling pour l'alimentation d'eau des chaudières.

Les filtres Darling pour l'alimentation d'eau des chaudières sont pour une pression de marche hydraulique de 250 livres.

La fig. 8 montre l'extérieur des plus gros modèles: Nos 5, 6 et 7. L'intérieur du filtre est tel qu'à la fig. 11.

Ces illustrations montrent le filtre Darling pour l'alimentation d'eau. Sa fonction est d'enlever l'huile dans l'eau d'alimentation des chaudières. Le filtre est habituellement raccordé entre la pompe d'alimentation et la chaudière. Il est offert en type simple ou double.

La fig. 9 illustre l'assemblage et l'agencement compact des soupapes de commande des Nos 1, 2, 3 et 4, pour permettre le by-pass lors du changement de la cartouche filtrante. Cet agencement avec soupapes n'est livré que sur demande et moyennant majoration.

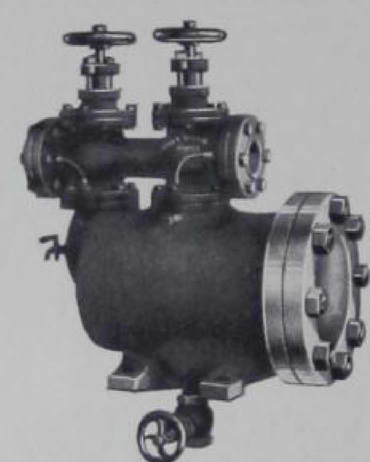
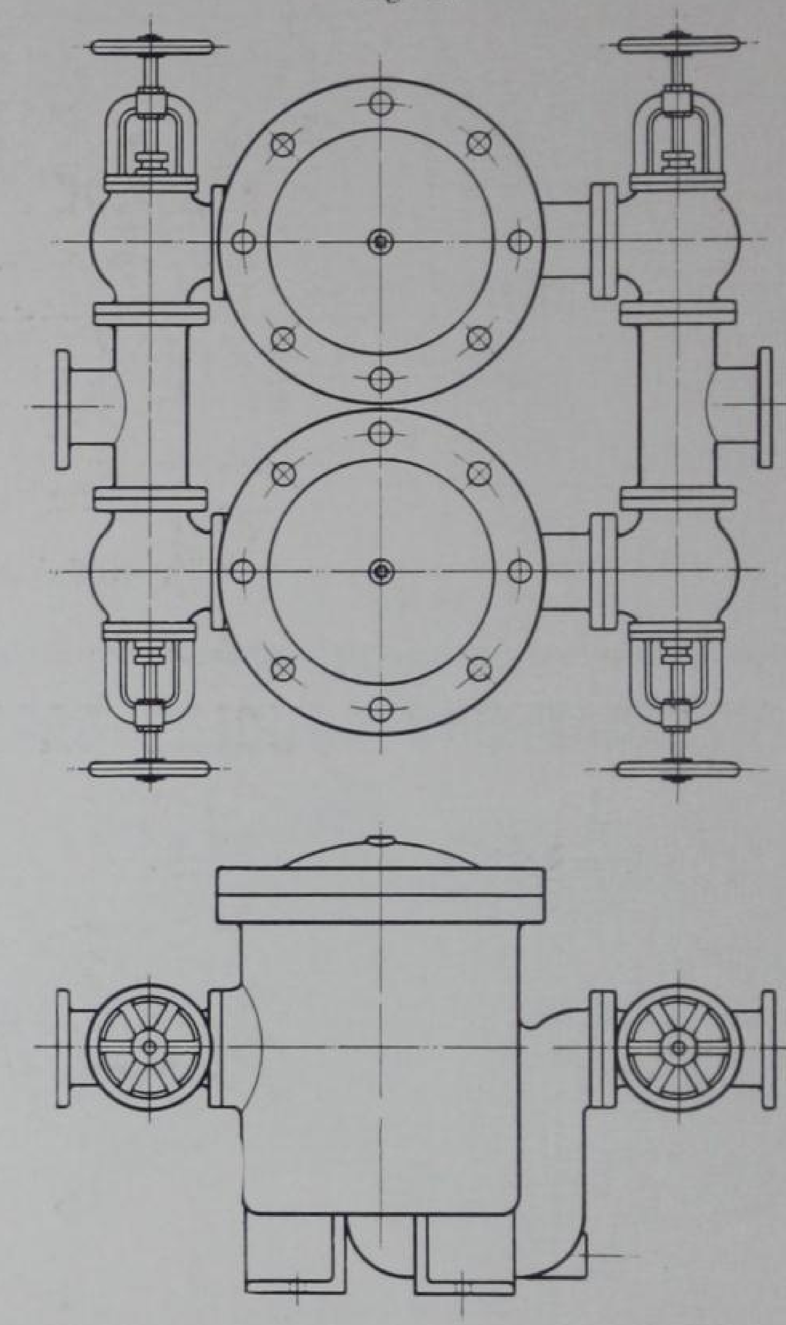


Fig. 9 — Filtre Darling pour l'alimentation d'eau avec collecteur.

Fig. 10.



La fig. 10 montre l'agencement des soupapes pour filtres doubles dans les grands diamètres. L'avantage d'un filtre double est qu'il y a toujours un filtre de disponible pendant le nettoyage de l'autre. Cet agencement de soupapes n'est fourni que moyennant majoration.

Le fonctionnement du filtre est vite compris en regardant la coupe à la fig. 11. L'eau entre par le dessus et passe dans la partie centrale du corps qui est occupé en toute sa longueur par la cartouche filtrante. A noter l'orifice de vidange.

Le filtre employé est de la toile bouclée à serviette (serviette turque) de bonne qualité. Ce tissu peut être nettoyé plusieurs fois; il se remplace à bon compte.

Cette cartouche forme une très grande surface de filtrage, ayant au moins 150 fois la superficie du tuyau d'entrée.

Lors du raccordement d'un filtre, on devrait poser un by-pass, afin de pouvoir nettoyer et remplacer la cartouche filtrante sans arrêter le fonctionnement des machines. Une cartouche filtrante de rechange est livrée avec chaque filtre.

TABLE VI — Rendement des filtres Darling pour l'alimentation d'eau des chaudières.

No	Diamètre	Poids	Rendement livres à l'heure
1	1	170	7,000
2	1½	190	10,000
3	2	340	17.000
4	2½	360	28,000
5	3	600	38,000
6	3½	650	50,000
7	4	800	65,000

Collecteur avec by-pass livré moyennant majoration.

Les Nos 1, 2, 3, 4 sont du modèle horizontal.

Les Nos 5, 6, 7 sont du modèle vertical.

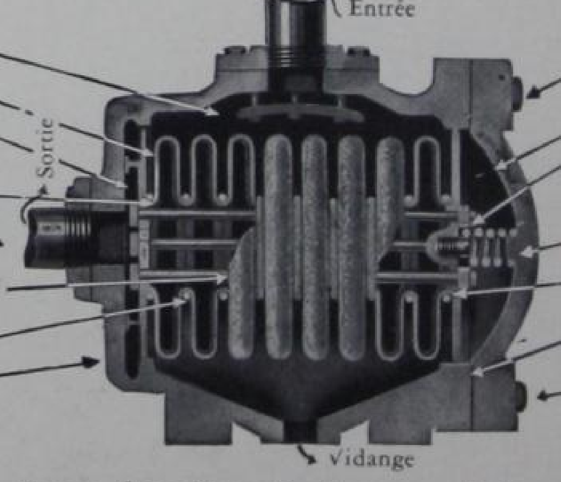


Fig. 11 — Coupe d'un filtre Darling pour l'alimentation d'eau des chaudières — Nos 1, 2, 3 et 4.

Webster **HEATING SYSTEM EQUIPMENT**

WEBSTER RADIATOR VALVES

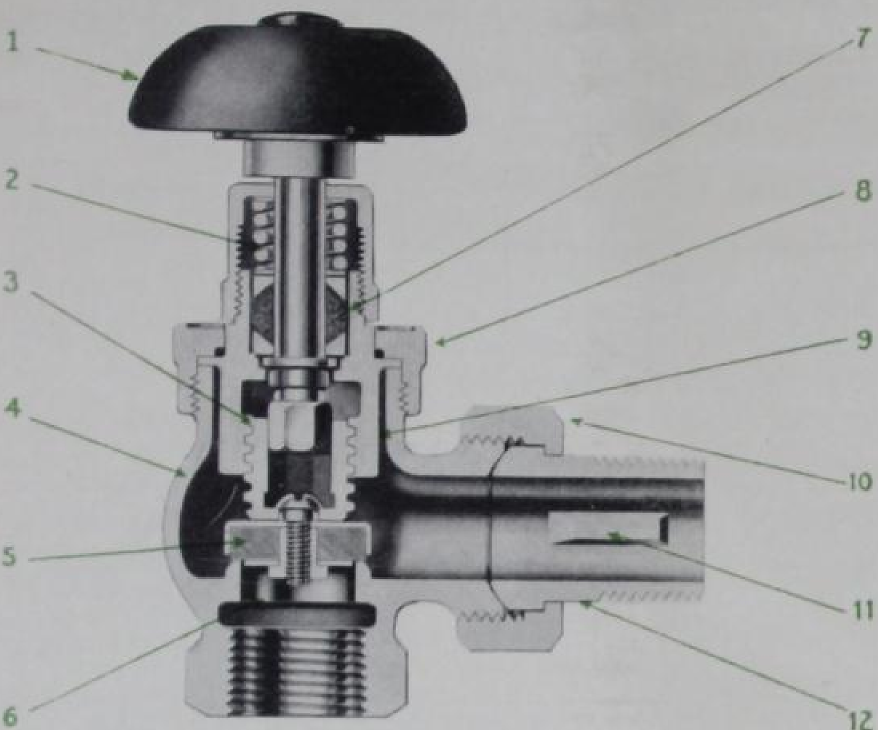


Fig. 1— Webster (Series 600P) Type "WB-P" Valve has spring-retained packing.

Type WB-P For Low Pressure Heating

The Webster Type WB-P Valve can be specified and recommended when radiator supply valves of highest quality are desired.

The Type WB-P Valve meets fully specifications calling for a "spring packless" valve. A heavy spring automatically maintains pressure on die-molded metallic ring packing.

Although packing seldom requires renewing, this valve is so designed that old packing ring can be removed and a new one installed while pressure is on the heating system.

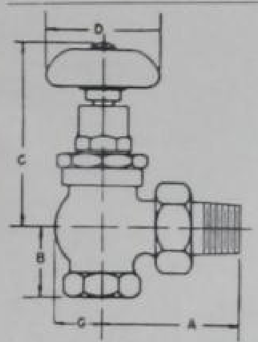
Pressures

For low pressure vapor and vacuum steam heating service.

Construction Features

1. Non-heat conducting wheel handle opens valve in less than a turn, non-rising stem.
2. Heavy spring automatically maintains pressure on the packing to prevent steam leakage.
3. Extra deep and wide Acme form threads on valve stem nut give unusual strength and provide ease in opening.
4. Steam brass body. Note generous thickness of metal at all points.
5. Renewable composition disc in sturdy brass retainer assures tight closing.
6. Modulation sleeve (not illustrated) is furnished on special order for 1/2, 3/4 and 1 inch sizes only and at slight added cost.
7. Die-molded metallic ring packing prevents leakage and lubricates valve stem. Can be repacked under pressure.
8. Bonnet or cap is brass. Arrows show direction of turning.
9. Fully machined stem nut guide holds all parts in alignment.
10. Fully machined brass nut.
11. Oversized broached lug provides extra strength.
12. Nipple turned from solid brass bar stock.

Table I. Dimensions of Type WB-P Valves, Angle Model.



Symbol	Size, Inches		Approximate Dimen., In.				
	Inlet	Outlet	A	B	C	D	G
W602PH	1/2	1/2	2 3/4	1 3/8	3 5/8	2 1/4	15/16
W603PH	3/4	3/4	2 3/4	1 3/8	3 5/8	2 1/4	15/16
W604PH	1	1	3 1/8	1 3/8	3 13/16	2 1/4	1 1/16
W605PH	1 1/4	1 1/4	3 5/8	1 7/8	4 15/16	3	1 7/16
W606PH	1 1/2	1 1/2	4	2	5	3	1 5/8

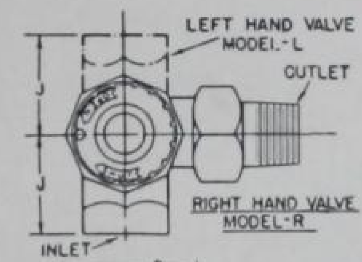
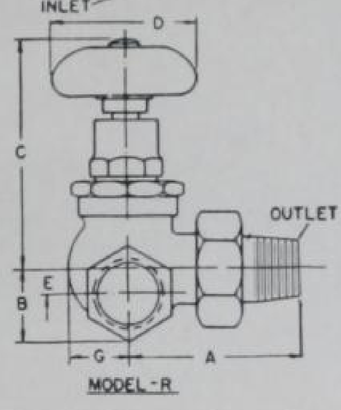
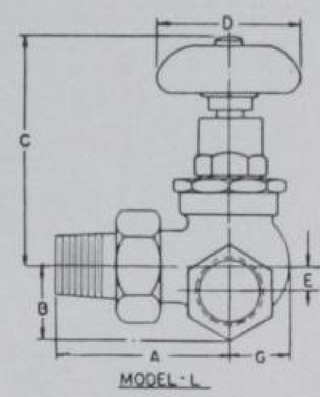


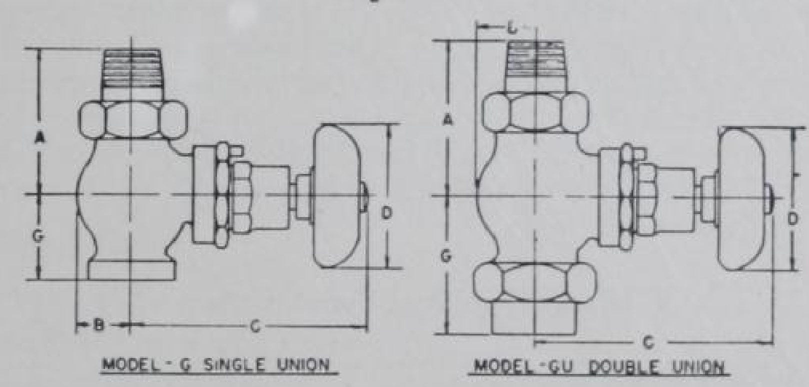
TABLE I-A. Dimensions of Type WB-P Valves, Right and Left Hand Models.





Symbol	Size, Inches		A	B	E	G	J	C	D
	In	Out							
W612PR, W622PL	3/4	1/2	2 3/4	1 3/16	3/8	15/16	1 9/16	3 5/8	2 1/4
W613PR, W623PL	3/4	3/4	2 3/4	1 3/16	3/8	15/16	1 9/16	3 5/8	2 1/4
W614PR, W624PL	1	1	3 1/8	1 3/8	7/16	1 1/16	2 1/16	3 13/16	2 1/4

TABLE II. Dimensions of Type WB-P Valves, Straight Models, Double and Single Union.



Symbol	Size, Inches		Approx. Dimensions, Inches				
	Inlet	Outlet	A	B	C	D	G
STRAIGHT SINGLE UNION—G MODEL							
W632PG	3/4	1/2	3	1	3 15/16	2 1/4	1 5/8
W633PG	3/4	3/4	3	1	3 15/16	2 1/4	1 5/8
W634PG	1	1	3 1/2	1 1/8	3 15/16	2 1/4	1 7/8
STRAIGHT DOUBLE UNION—GU MODEL							
W642PGU	3/4	1/2	3	1	3 15/16	2 1/4	2 11/16
W643PGU	3/4	3/4	3	1	3 15/16	2 1/4	2 11/16
W644PGU	1	1	3 1/2	1 1/8	3 15/16	2 1/4	2 13/16

WEBSTER THERMOSTATIC TRAPS

Series 7 for Low Pressure Applications

The Webster Series 7 Trap is a diaphragm type, thermostatic trap designed for low pressure vapor and vacuum steam heating service. Recommended maximum operating pressure is 15 lbs. per sq. in., although higher occasional pressures are permissible. It is recommended for all types of radiators, drip points, steam-using equipment, and other applications within its pressure and capacity range.

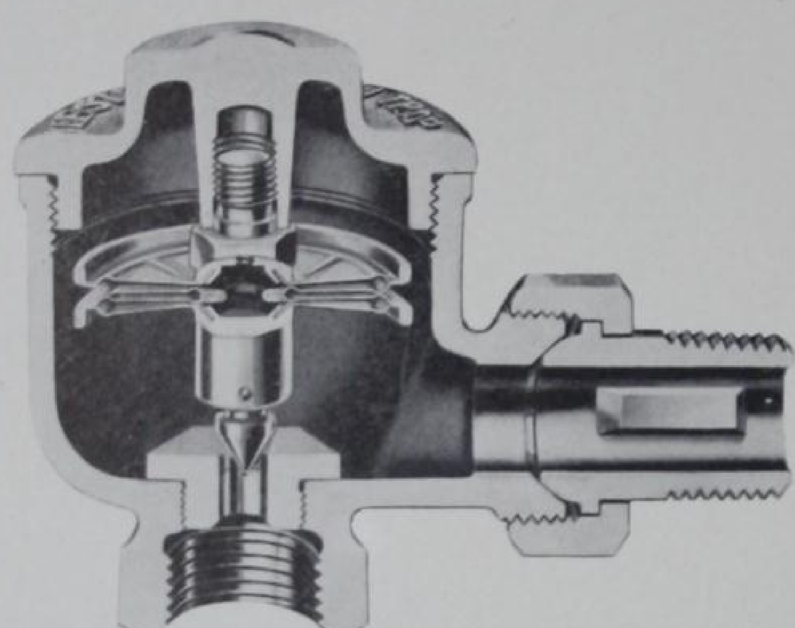


Fig. 2—Webster 702H Thermostatic Trap.

Compensated for All Pressures

With Webster Series 7 Traps, steam is held in the radiator until it has given up its useful heat. These traps do not open too soon and waste steam into the returns. Neither do they close too quickly so that condensate builds up and reduces radiator output. Water of condensation, air and other gases are completely and continuously discharged whether the pressure inside the radiator is 15 lbs., a low vacuum or at any intermediate point. This is accomplished by *compensating for pressure variation*, a feature of all Webster Thermostatic Traps.

High Quality Construction

The thermostatic element of Webster Series 7 Traps is a strong double diaphragm of Monel Metal, a non-corrosive metal that retains its "spring" characteristic under widely varying conditions of temperature and pressure. Note in the illustration that diaphragm joints are triple-sealed, i.e., tinned, rolled, and soldered to assure tightness. Ribs are provided for structural strength. The pointed valve piece is permanently adjusted. This valve, of brass, has a 60 degree cone shape to give positive and tight closing. Experienced operating men know the value of this design in keeping a heating system free from interruptions due to dirt.

Body and cap are high quality steam brass. Machined metal-to-metal surfaces provide tight joints. Sharp-edged seat is brass and is threaded for ease of replacement. Union nut and nipple are brass and of ample strength to withstand rough handling during installation.

After complete assembly, each trap is tested with both hot water and steam. No trap is permitted to leave the factory that has not passed all inspections and tests and proved that it will function properly.

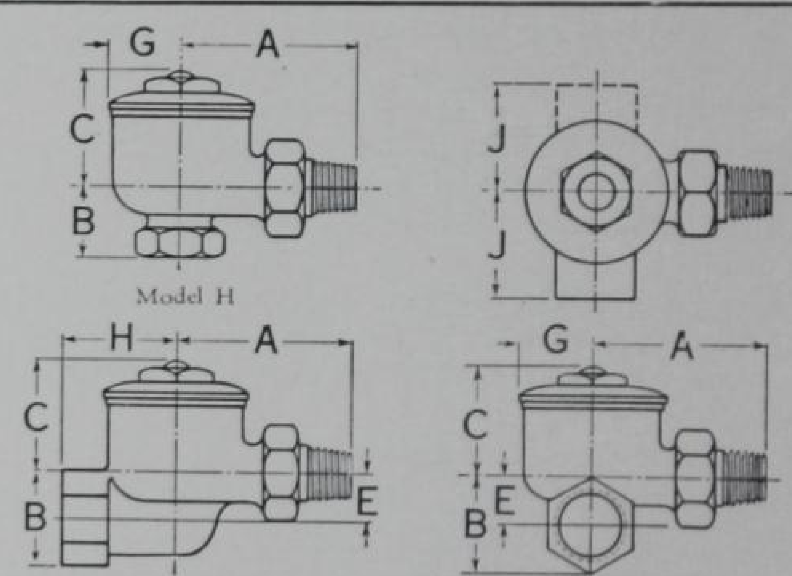
Series 7M for Medium Pressures

The Webster Series 7M Trap which is provided with a stainless steel valve piece and a stainless steel seat insert is recommended for operating pressures up to 25 lbs. per sq. in., and for occasional pressures up to 50 lbs. per sq in. In every other respect the Series 7M is identical to the Series 7.

Table III. Recommended Ratings in Sq. Ft. E.D.R.*

Symbol	Size	Pressure Difference Across Trap in Lb. per Sq. In.							
		¼	½	1	1½	2	5	10	15
702	½	85	120	165	200	235	370	530	640
713	¾	165	230	330	400	465	730	1050	1300
724	1	290	410	580	700	810	1280	1840	2300

*Based on 240 B.t.u. per sq. ft. per hour. Ratings are in accordance with the recommended standards adopted by the Steam Heating Equipment Manufacturers Association. Select trap directly from the above table, for the lowest differential that may exist in the system.



Model H

Model G

Models R and L

Series 7 Trap Dimensions. Angle (H), Straightway (G), Right (R) and Left (L) Models.

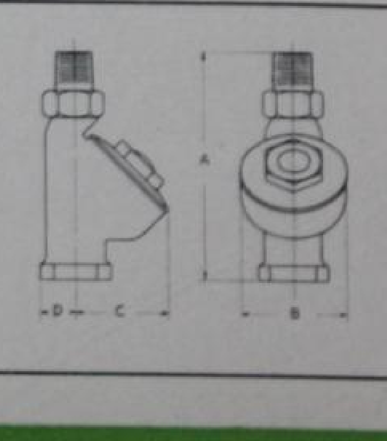
Table IV. Series 7 Trap Dimensions. Models H, G, R and L.

Size	Symbol	Model	A	B	C	E	G	H	J
½	702	H	2¾	1⅛	1 13/16		1 3/16		
½	702	G	2¾	1½	1 13/16	¾		1 13/16	
½	702	R & L	2¾	1½	1 13/16	¾	1 3/16		1⅝
¾	713	H	3 9/16	1 7/16	1 11/16		1⅝		
¾	713	G	3 9/16	1 11/16	1 11/16	¾		2¼	
1	724	H	4¼	1 13/16	2 3/16		1⅞		

All dimensions in inches and subject to slight variation.

Dimensions of Single Union Vertical Model 702V Trap ½" Inlet, ½" Outlet. For Convector Radiators and other Applications.

A—5" C—2"
B—2 5/16" D—¾"



WEBSTER FLOAT AND THERMOSTATIC DRIP TRAPS

Working Pressures To 15 Lbs. Per Sq. In.

SERIES 26-T: Heavy duty traps, capable of handling large volumes of condensation and air. Compact and light in weight. Suited for drips of mains, air conditioning coils, blast radiation, unit heaters, hot water generators, fan heater coils, and similar applications. Side outlet opening. The most used sizes (00026, 0026, 026) incorporate the *outward opening* discharge valve—which permits the valve to open when excessive pressures prevail, and thus prevents waterlogged piping or equipment.

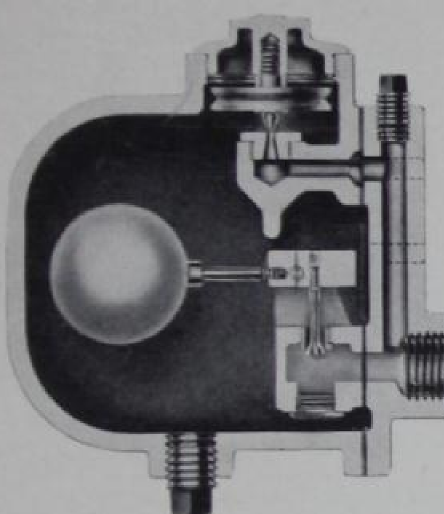


Fig. 3—Webster Heavy Duty Drip Trap, Size 00026-T

Construction Features: Brass valve pieces and seats on water discharge end. Thermostatic air vent diaphragms are Monel Metal with valve pieces and seats of brass. Other interior parts are copper, brass or iron. Cast iron bodies and covers.

Size 00026 has one inlet opening and one outlet on cover plate. A choice of two inlet openings in opposite sides of body and two outlet openings at bottom is provided in sizes 0026 and 026. Pipe plugs included for one inlet and outlet. These sizes can be mounted in pipe line without other support.

Sizes 126 and 226 have single end inlets and oulets and require a supporting bracket when installed. Large ball float and long lever provide ample power for operation of inward-opening valve.

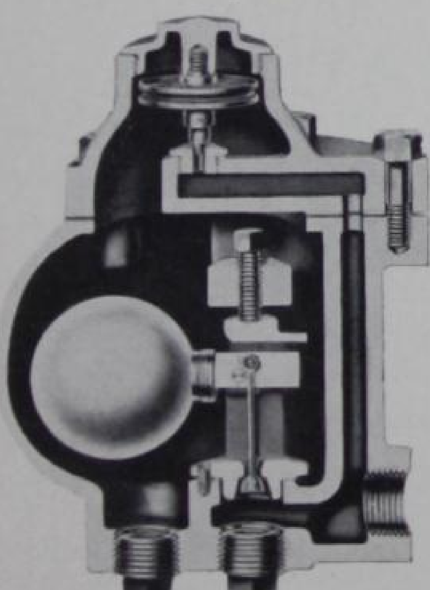


Fig. 4—Webster Heavy Duty Drip Trap, Size 0026-T. The 026-T is similar excepting that float interior is bolted instead of clamped

SERIES 26-0: Similar to the 26-T but with plain cover instead of cover incorporating thermostatic element and by-pass. Used where concentration of air does not occur, such as on ends of mains and risers, on flash tanks and for dripping gravity heating systems into vacuum return lines. Provision is made for external air by-pass.

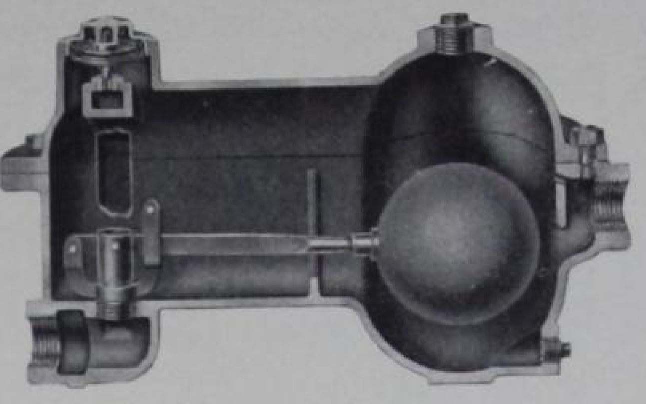
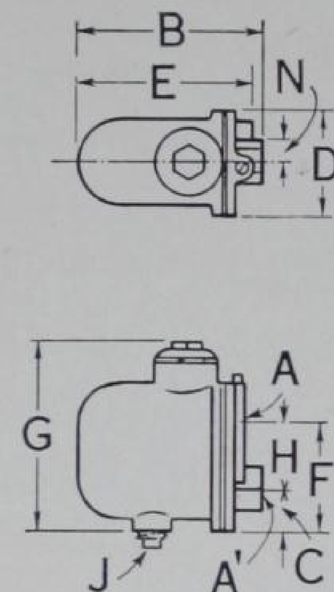
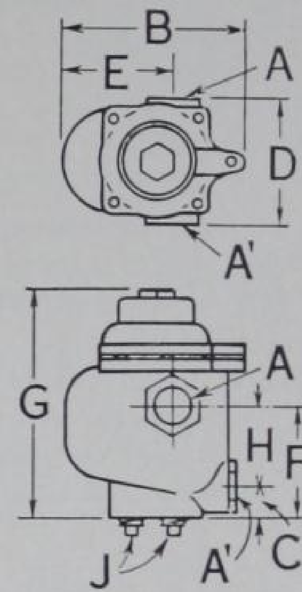


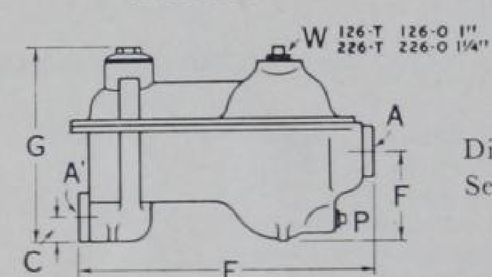
Fig. 5—Webster Heavy Duty Drip Trap, Size 126-T. The 226-T is similar.



00026 Size



0026 and 026 Size



126 and 226 Size

Dimensions of Webster Series 26 Drip Traps.

Table V. Dimensions of Webster Series 26 Drip Traps

Symbol	A	B	C	D	E	F	G	H	J or P	Net Wt. Lbs.
00026-T	¾	6⅝	1½	3¾	6⅛	3⅞	6⅝	2⅜	½	10
00026-O	¾	6⅝	1½	3¾	6⅛	3⅞	6⅝	2⅜	½	10¼
0026-T	1	6⅜	1⅛	4½	3 15/16	3 15/16	8⅝	2 13/16	1	13¼
0026-O	1	6⅜	1⅛	4½	3 15/16	3 15/16	7 1/16	2 13/16	1	12¼
026-T	1¼	8 3/16	2½	5⅛	4⅞	5⅝	10½	3⅛	1¼	19
026-O	1¼	8 3/16	2½	5⅛	4⅞	5⅝	8 7/16	3⅛	1¼	17½
126-T	1½	......	1⅜	......	15	4⅝	10½	......	½	45
126-O	1½	......	1⅜	......	15	4⅝	9	......	½	38
226-T	2	......	1⅝	......	18⅜	5½	12	......	½	62
226-O	2	......	1⅝	......	18⅜	5½	11⅜	......	½	55

00026 Dimension N is ¾"

All dimensions in inches and subject to slight variation.

Table VI. Recommended Ratings of Webster Series 26 Float and Thermostatic Traps in Lbs. Water per Hour

Size Inches	Symbol	Pressure Difference Across Trap in Lbs. per Sq. In.								
		⅛	¼	½	¾	1	2	5	10	15
¾	00026-T and O	50	70	100	120	140	200	210	220	230
1	0026-T and O	125	175	250	300	350	500	525	550	575
1¼	026-T and O	300	425	600	735	850	1200	1260	1320	1380
1½	126-T and O	600	850	1200	1470	1700	2400	2520	2640	2760
2	226-T and O	1250	1775	2500	3060	3550	5000	525C	5500	5750

Conversion Factors: To convert ratings given in lbs. per hour of water to sq. ft. e.d.r. at 240 B.t.u., multiply by 4. Ratings are in accordance with standards adopted by the Steam Heating Equipment Manufacturers Association, providing for the continuous elimination of air when the trap is operating at its maximum rating.

DARLING "Y" TYPE STRAINERS

Fig. 6—Darling Series 29 Dirt Strainers

Screwed Pattern — maximum working pressure 150 lbs. per sq. in.

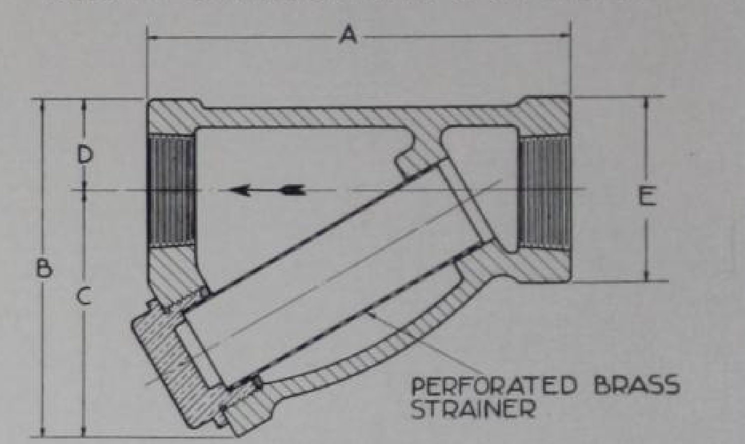
Pipe scale, sediment, bits of packing, and other foreign matter is often the cause of damage to steam traps, pressure reducing valves, temperature regulators, etc. and unsatisfactory operation or even complete failure can frequently be attributed to pipe line impurities. Therefore the installation of a strainer is always recommended to protect such equipment.

Darling Series 29 Strainers are so constructed that they do not reduce the volume of fluid passing through them. The screen is placed with one end open to the inlet port and the other end open to the blow off. The flow passes from inlet to outlet port through the screen so that all foreign matter is trapped in the cylinder screen, from where it is readily removed.

Adaptable to both horizontal and vertical downward flow pipe lines. In either position these strainers must be installed with the cap down.

Darling "Y" type Strainers have heavy cast iron bodies with perforated brass strainer cylinders, area of which are several times larger than corresponding pipe sizes. Series 29 are screwed pattern made in sizes ½" to 2" inclusive. Standard cylinder screens have .040 inch diameter perforations 256 holes to the sq. in. Screens of monel metal can be supplied at extra charge. Fine mesh screens made of brass wire cloth can be furnished when specified.

TABLE VII. Dimensions of Series 29 Dirt Strainers.



Size Inches	Symbol	A	B	C	D	E	Weight
½	292	3⅜	2⅞	2⅛	¾	1½	2
¾	293	4¼	3 7/16	2½	15/16	1⅞	3
1	294	5⅛	4	2 15/16	1 1/16	2⅛	4
1¼	295	5 13/16	4⅝	3⅜	1¼	2½	6
1½	296	6½	5 13/16	3¾	1 7/16	2⅞	8
2	298	8	6 9/16	4⅞	1 11/16	3⅜	13

All dimensions in inches and subject to slight variation. Weight in pounds.

OTHER WEBSTER HEATING SYSTEM EQUIPMENT

	Bulletin Number
Webster High Capacity Baseboard	**B–1601**
Webster Wallvectors	**B–1551**
Webster W. I. Radiation	**B–1550–C**
Webster Baseboard Heating	**5–CE**
Webster Continuous Flow Control for Hot Water Heating	**B–200**
Webster Process Steam Traps	**1200–H**
Webster Type "N" Expansion Joints	**B–1103–B**
Webster Type "C" Expansion Joints	**B–1101–B**
Webster Boiler Protector	**B–727–E**
Webster E-5 Moderator Controls	**B–9004–A**

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SAINT JOHN, N.B.
E. S. Stephenson & Co., Ltd. .... 15 Dock Street

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W. J. Banks .... 140 St. John Street

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Patricia Engineering Ltd. .... 46½ Third Ave.

OTTAWA, ONT.
Darling Brothers Limited .... 18 Rideau Street

TORONTO, ONT.
Darling Brothers Limited .... 137 Wellington St. W

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Darling Brothers Limited .... 123 Princess Stre

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H. F. Clarke & Co. Ltd. .... 1114 Fifth St. W

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DARLING BROTHERS LIMITED

140 PRINCE ST. MONTREAL, CANADA

SINCE 1888

DARLING

STRAINERS AND FILTERS

"Y" TYPE STRAINERS

Pipe scale, sediment, bits of packing, and other foreign matter is often the cause of damage to pressure reducing valves, temperature regulators, steam traps, etc. and unsatisfactory operation or even complete failure can frequently be attributed to pipe line impurities. Therefore, the installation of a strainer is always recommended to protect such equipment.

Darling Series 29 and Series 30 Strainers are so constructed that they do not reduce the volume of fluid passing through them. The screen is placed with one end open to the inlet port and the other end open to the blow off. The flow passes from inlet to outlet port through the screen so that all foreign matter is trapped in the cylinder, from where it is readily removed.

Adaptable to both horizontal and vertical downward flow pipe lines. In either position these strainers must be installed with the cap down.

Darling "Y" type Strainers have cast iron bodies with perforated brass strainer cylinders, area of which are several times larger than corresponding pipe sizes. Series 29 are screwed pattern made in sizes 1/2" to 3" inclusive. Series 30 flanged pattern are made in sizes 2 1/2" to 6" inclusive and in two weights, standard for pressures up to 150 lbs. per sq. in. and extra heavy for pressures up to 250 lbs. per sq. in. Standard cylinder screens have .040 inch diameter perforations 225 holes to the sq. in. Screens of monel metal can be supplied at extra charge. Fine mesh screens made of brass wire cloth can be furnished when specified.

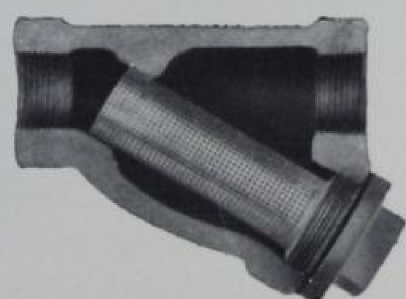
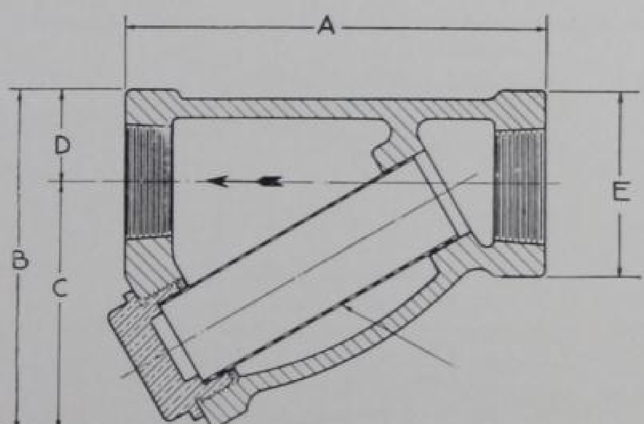


Fig. 1. Darling Series 29 Dirt Strainers.
Screwed Pattern—maximum working pressure 150 lbs. per sq. in.

TABLE I — Dimensions of Series 29 Dirt Strainers.

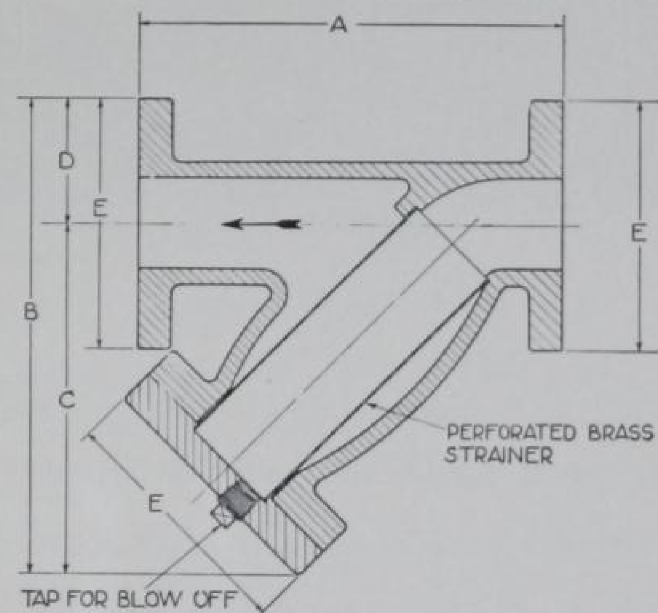


Size Inches	Symbol	A	B	C	D	E	Weight
1/2	292	3 5/8	2 7/8	2 1/8	3/4	1 1/2	2
3/4	293	4 1/4	3 7/16	2 1/2	15/16	1 7/8	3
1	294	5 1/8	4	2 15/16	1 1/16	2 1/8	4
1 1/4	295	5 13/16	4 5/8	3 3/8	1 1/4	2 1/2	6
1 1/2	296	6 1/2	5 13/16	3 3/4	1 7/16	2 7/8	8
2	298	8	6 9/16	4 7/8	1 11/16	3 3/8	13
2 1/2	2910	9 3/4	7 15/16	5 3/4	2 3/16	4 3/8	22
3	2912	11 1/4	9 1/4	6 3/4	2 1/2	5	36

All dimensions in inches and subject to slight variations. Weight in pounds.

Fig. 2. Darling Series 30 Dirt Strainers.
Standard flanged pattern—maximum working pressure 150 lbs. per sq. in. Extra heavy flanged pattern—maximum working pressure 250 lbs. per sq. in.

TABLE II — Dimensions of Series 30 Dirt Strainers.



Standard Pattern

Size Inches	Symbol	A	B	C	D	E	Weight
2 1/2	3010	13	14 1/4	10 3/4	3 1/2	7	70
3	3012	14	15	11 1/4	3 3/4	7 1/2	80
4	3016	16 1/2	18 1/4	13 3/4	4 1/2	9	170
5	3020	18 5/8	20 1/8	15 1/8	5	10	190
6	3024	20 3/4	22 1/8	16 5/8	5 1/2	11	250

Extra Heavy Pattern

Size Inches	Symbol	A	B	C	D	E	Weight
2 1/2	3010	13	14 5/8	10 7/8	3 3/4	7 1/2	80
3	3012	14	15 5/8	11 1/2	4 1/8	8 1/4	100
4	3016	16 1/2	19	14	5	10	180
5	3020	18 5/8	21	15 1/2	5 1/2	11	220
6	3024	20 3/4	23 3/8	17 1/8	6 1/4	12 1/2	280

All dimensions in inches and subject to slight variations. Weight in pounds.

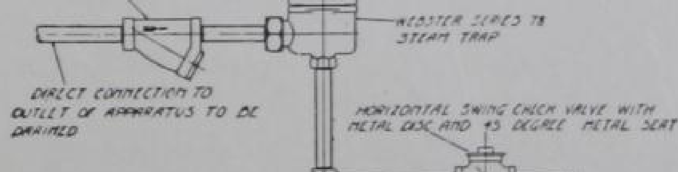


Fig. 3. Typical Installation with Webster "78" Trap.

TYPE "D" DUPLEX STRAINERS

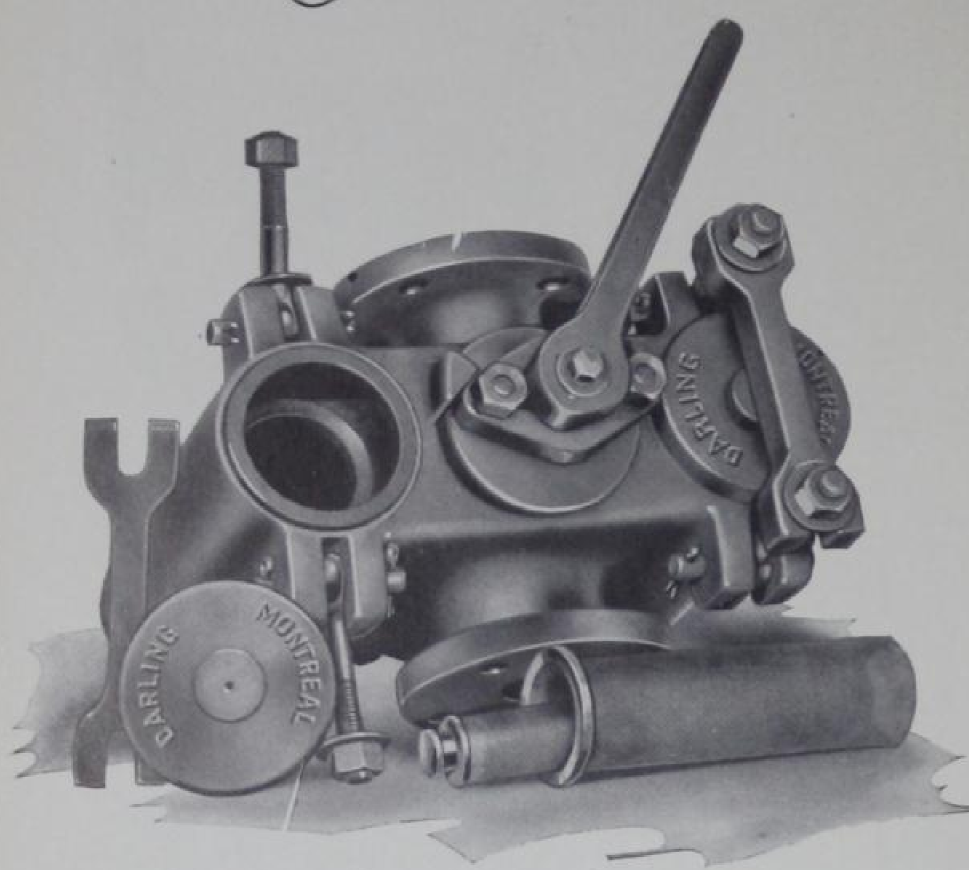


Fig. 4. Duplex Strainer.

This duplex strainer has a wide application in many industries, but is particularly suited to Fuel Oil Burning installations.

The principal advantages of Darling Type "D" Duplex Strainers are as follows:

No valves — a 90-degree turn of the handles changes from one to the other basket.

Positive adjustment of tapered plug valve by means of jack screw.

Strainer basket being in two parts is more readily cleaned.

TABLE III

Size	A		B	C	D
	Std. Flange	Ext. Heavy Flange			
1½"	8¾"	9¼"	12"	7½"	10"
2"	10⅜"	10⅞"	16"	8"	12"
2½"	12"	12⅝"	18"	10"	13½"
3"	13"	13¾"	19"	12"	17"

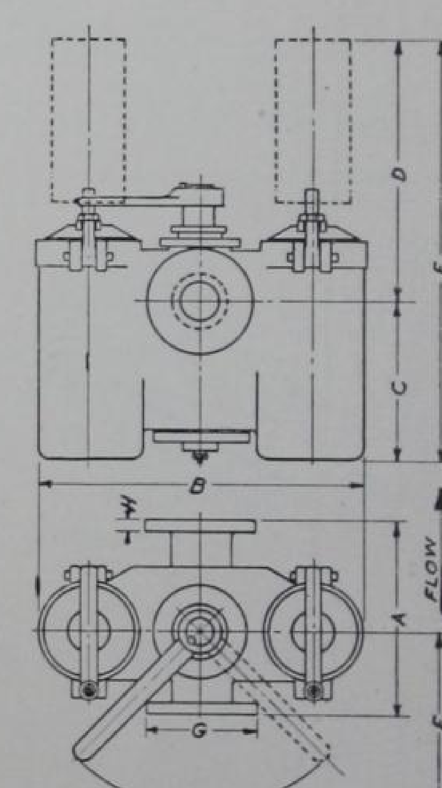
Double basket (the combined area of whose per forations is from six to ten times the cross sectiona area of the pipe and about twice the area of othe makes of strainers).

Designed so that when well cover is removed leve of liquid in well is lowered, exposing the top of baske for removal. Tongue and Groove joints on well covers

Handle partially covers basket-well which is in use leaving exposed the well which is out of commissio and free to be cleaned. In no position of handle is i possible to stop the flow.

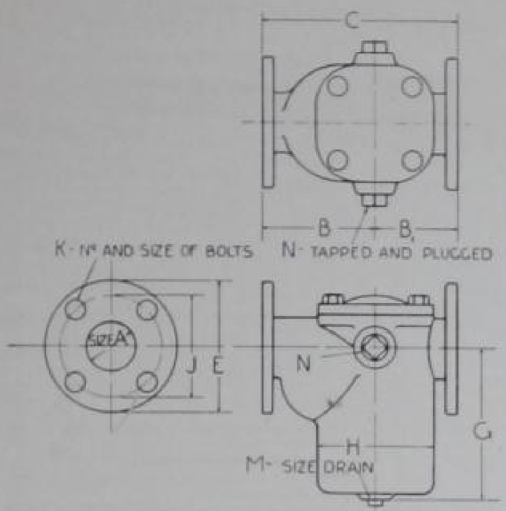
Elimination of the many joints necessary in a duple strainer made up with valves.

Maximum working pressure 100 lbs. Available i cast steel for pressures over 100 lbs.



STRAINERS AND FILTERS

WEBSTER SUCTION STRAINERS



Size A	B	B_1	C	E	G	H
2	5⅜	4	9⅜	6	6⅞	5¼
3	6⅛	4⅞	11	7½	8⅞	5¾
4	8½	5⅜	13⅞	9	10⅝	7⅛
5	9⅜	6⅛	15½	10	12⅛	8¼
6	10⅜	7	17⅜	11	13¾	9⅝
8	14⅛	9⅞	24	13½	21	14½
10	17¼	11¼	28½	16	24⅞	16¾
12	21	12⅞	33⅞	19	29	20

Size A	J	K	M	N
2	4¾	4-⅝x2	½	¾
3	6	4-⅝x2¼	½	¾
4	7½	8-⅝x2¾	½	¾
5	8½	8-¾x2¼	½	¾
6	9½	8-¾x2¼	½	¾
8	11¾	8-¾x3⅛	¾	1
10	14¼	12-⅞x3½	¾	1
12	17	12-⅞x3½	¾	1

TABLE IV — Dimensions of Webster Suction Strainers.

Installed ahead of vacuum pump to prevent dirt and scale, brought down with condensation from heating system, from damaging pump with resultant troubles.

A tapping is provided for introduction of cold water make-up when that is desired; another for connection to a vacuum gauge. Made of heavy cast iron with flanged connections. Companion flanges are extra equipment. Cleanout cover is bolted on with rubber gasket joint. Screen basket is made of sheet brass with No. 4 holes (.045 in dia.), 225 holes per sq. in. and is easily removable for cleaning. Maximum working pressure, 15 lbs. per sq. in.

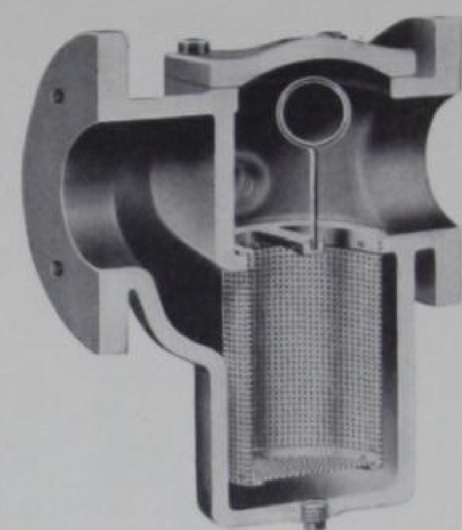


Fig. 5. Webster Suction Strainers.

DARLING TYPE "W" DUPLEX SUCTION STRAINERS

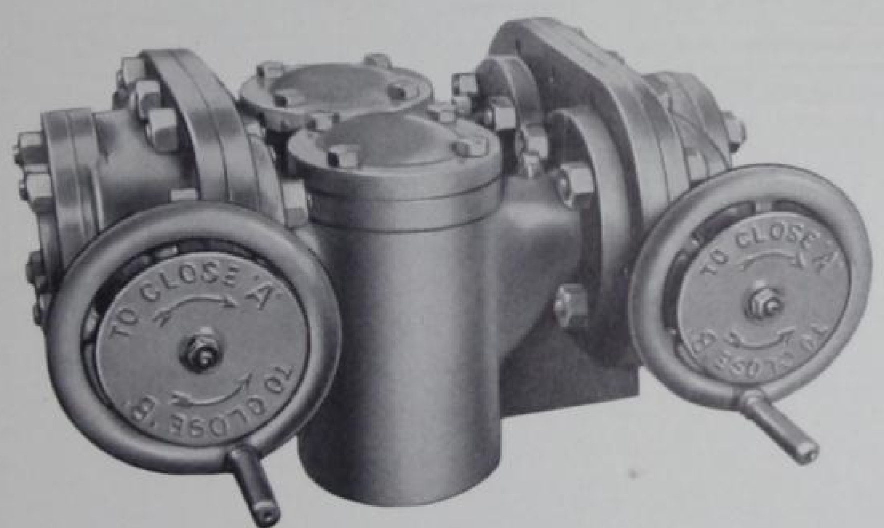


Fig. 6. Darling Duplex Strainers.

The principal advantages of the duplex suction strainer is where continuous operation is required; it is possible to shut off one strainer and use the other, permitting the first one to be cleaned and made ready in a few moments for future use.

Of rugged design, it is a dependable unit and often used in suction lines from oil tanks and other special applications.

Made in sizes from 4" to 8".

Companion flanges included as part of the unit.

Maximum working pressure 15 lbs. per sq. in.

TABLE V — Dimensions of Darling Duplex Strainers.

Size	Face to Face	Overall Width	Overall Height	Extra space for strainer removal	Weight
4	24	28	16⅝	14⅝	600
5	28⅛	32¼	19⅞	14¼	790
6	30	34	21½	15¼	950

DARLING WATER SUPPLY FILTERS

An adaptation of the Darling Feed water filter shown on page 4. The filtering media is Linen Terry (Turkish towelling). The body is of welded steel construction. This filter is recommended for use on water supply systems where it is necessary to remove suspended matter. Spare filter cartridges are available which will facilitate the servicing of these units.

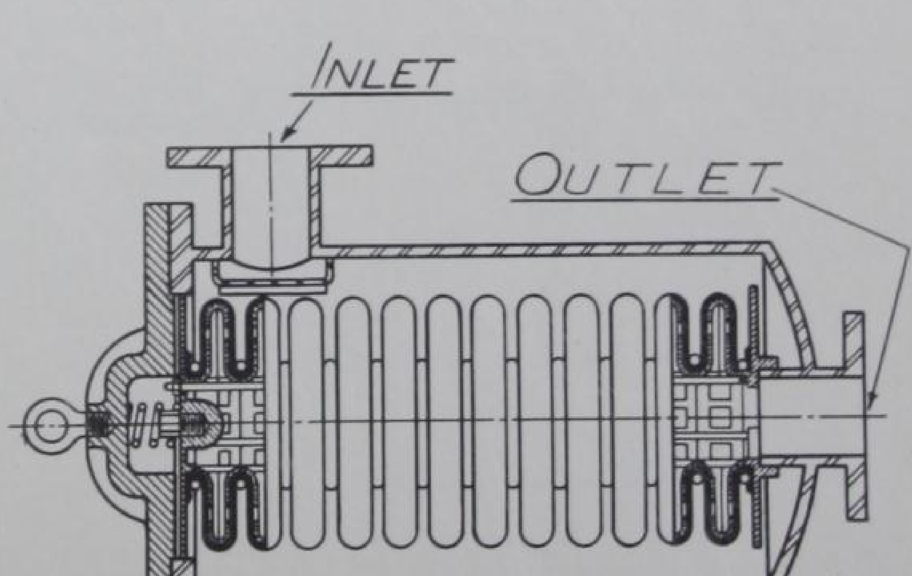


Fig. 7.

FEED WATER FILTERS

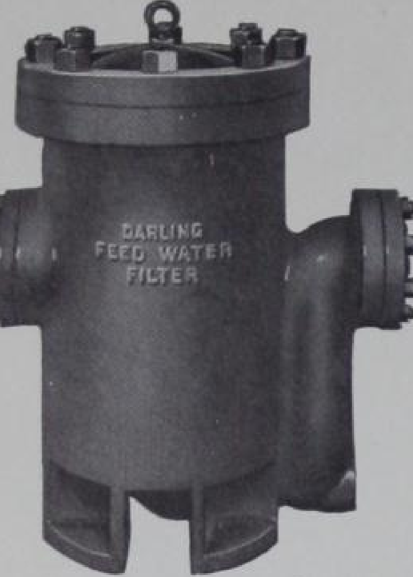


Fig. 8. Darling Feed Water Filter.

Darling Feed Water Filters are suitable for water pressures up to 250 lbs.

Fig. 8 shows exterior view of the larger sizes No. 5, 6 and 7. The interior of filter is same as shown in Fig. 11.

These illustrations show the Darling Feed Water Filter. Its function is to remove oil from boiler feed water. The filter is usually connected between the feed pump and the boiler. Single or duplex types can be supplied.

Fig. 9 illustrates assembly and compact arrangement of control valves of No. 1, 2, 3 and 4 sizes of filter, to permit by-passing when changing filtering media; this valve arrangement is furnished as an extra only.

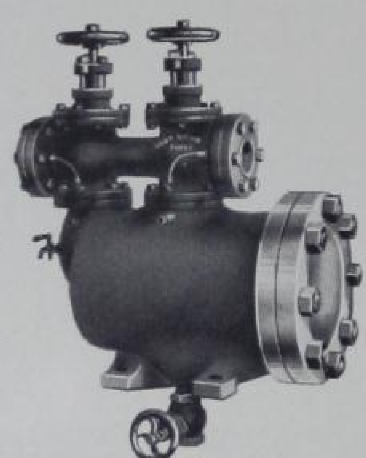


Fig. 9. Darling Feed Water Filter with manifold.

Fig. 10.

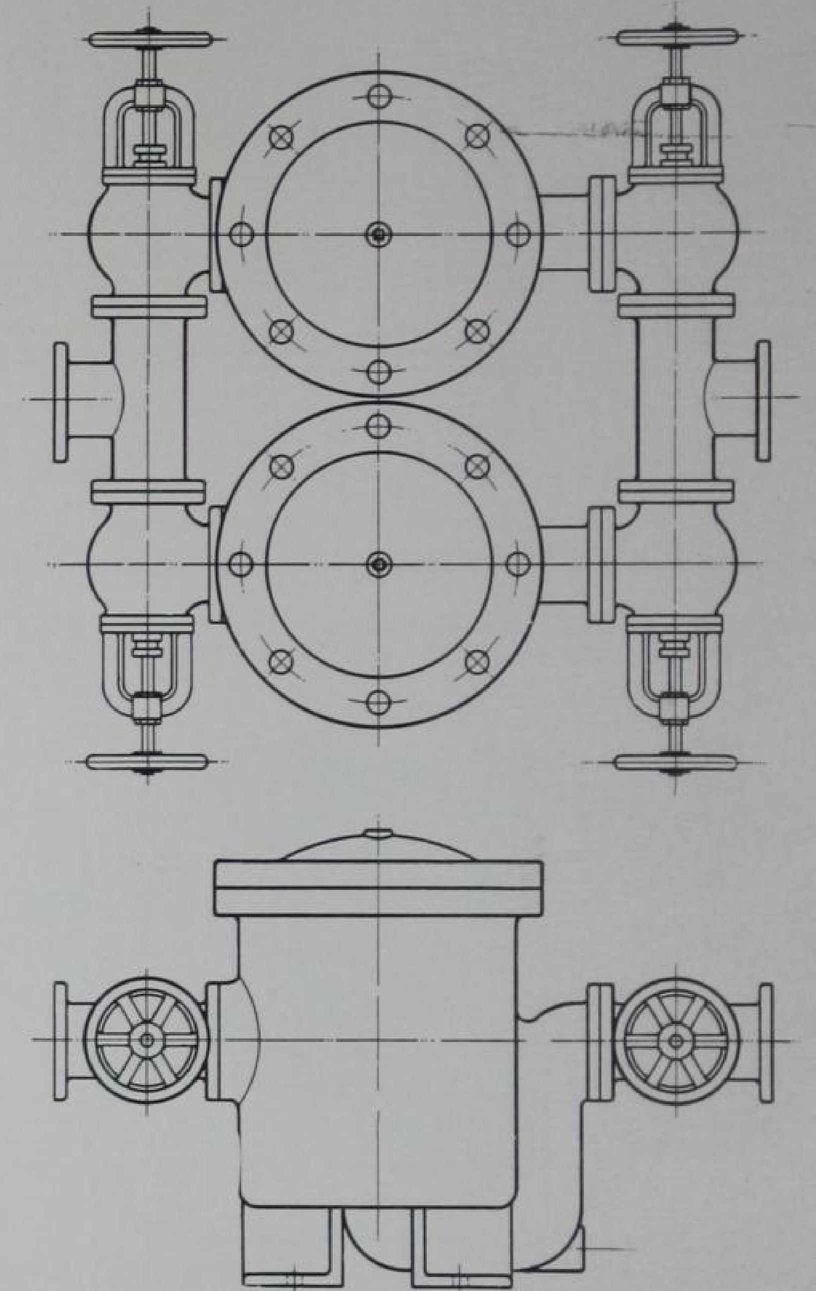


Fig. 10 shows outline of valve arrangement for duplex filters in the larger sizes. The advantage of using same is that one filter is available at any time for cleaning. This valve arrangement is furnished as an extra only.

By reference to the sectional illustration Fig. 11 the operation of the filter will be readily understood. The water enters at the top and passes into the central portion of the chamber which is occupied by the filter cartridge which extends horizontally the entire length. Note Blow-off for cleaning filter body.

The filtering material employed is what is familiarly known as Linen Terry (Turkish towelling) of fine quality. This can be cleaned several times. New towelling can be had at reasonable price.

It presents a very large filtering area, having at least 150 times the area of the feed pipe.

In connecting the filter a by-pass should be provided so that the same may be cleaned and fresh filter cartridge inserted without shutting down the plant. An extra filter cartridge is supplied with each filter.

TABLE VI — Capacity Darling Feed Water Filters.

No.	Size	Weight	Capacity Lbs. per hour
1	1	170	7,000
2	1½	190	10,000
3	2	340	17,000
4	2½	360	28,000
5	3	600	38,000
6	3½	650	50,000
7	4	800	65,000

By-Passing Manifold furnished at extra price only.

Sizes 1, 2, 3, 4 are horizontal pattern.

Sizes 5, 6, 7 are vertical pattern.

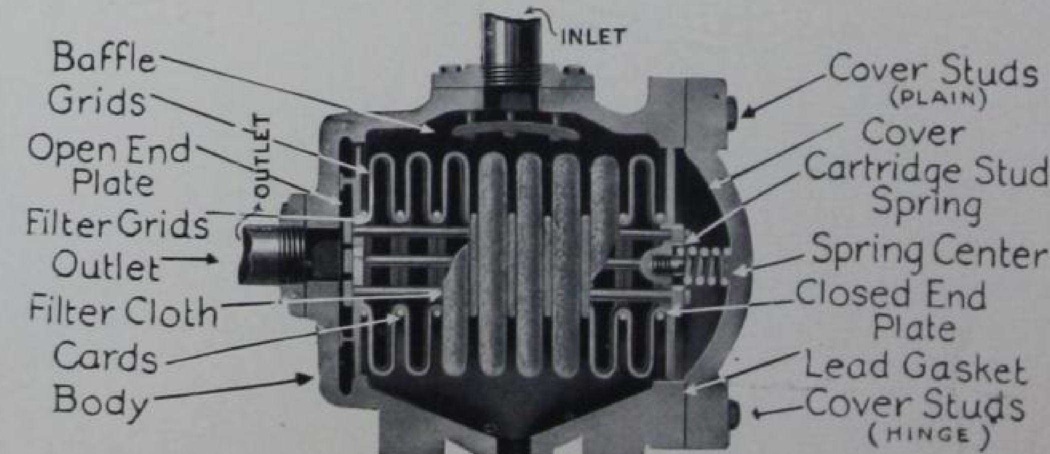


Fig. 11. Sectional View Darling Feed Water Filter — Sizes 1, 2, 3 and 4.

CANADIAN HOMEOWNERS SAY...

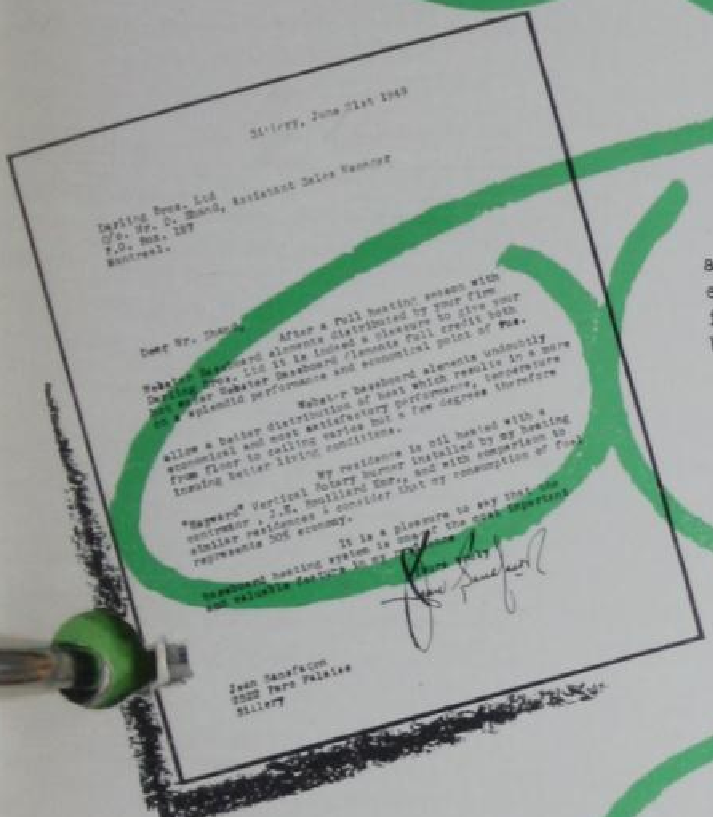
IT SAVES MONEY!
ELIMINATES DRAFTS!
GIVES EVEN HEAT!
DOES NOT SOIL WALLS!

THEY'RE TALKING ABOUT...

Webster

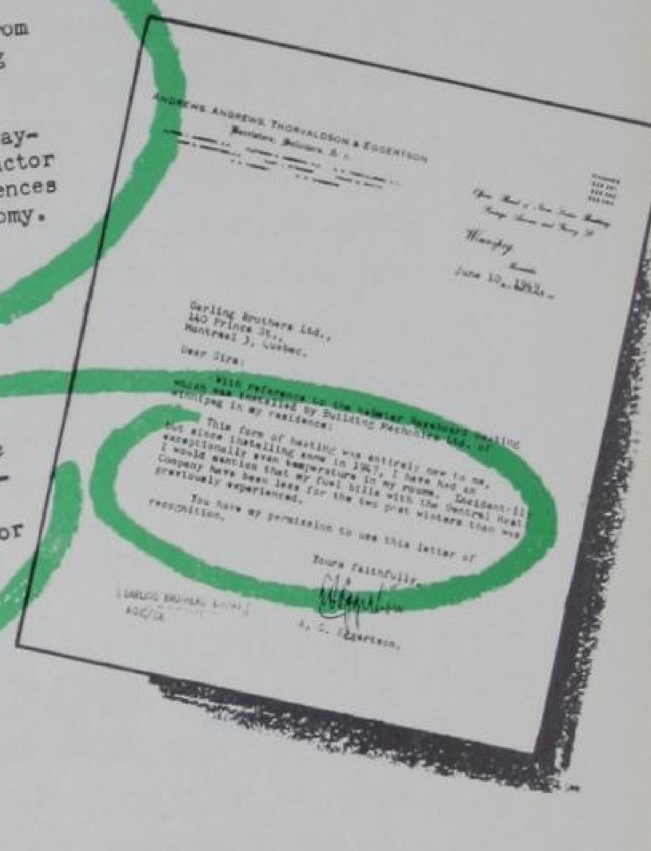
BASEBOARD HEATING

YOU'LL BE INTERESTED IN WHAT THESE PEOPLE ARE SAYING:

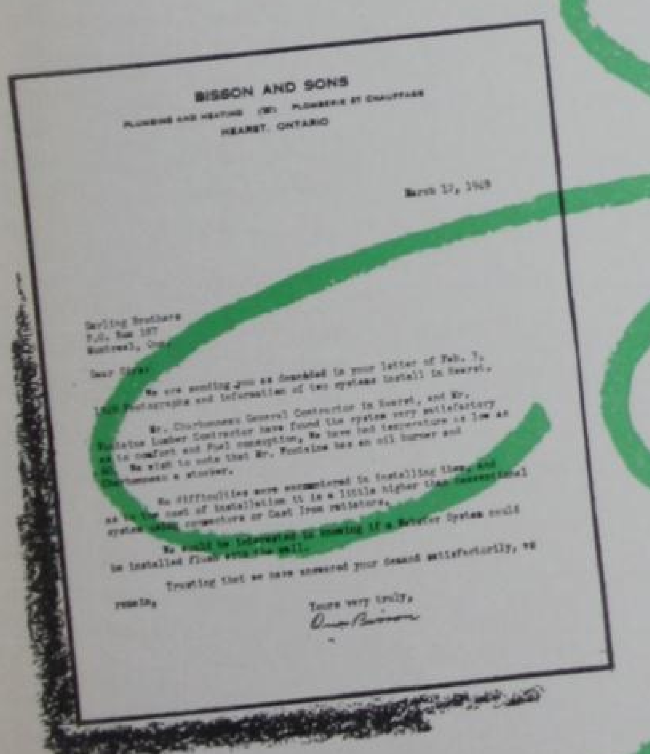


Webster baseboard elements undoubtly allow a better distribution of heat which results in a more economical and most satisfactory performance, temperature from floor to ceiling varies but a few degrees therefore insuring better living conditions.

My residence is oil heated with a "Hayward" Vertical Rotary burner installed by my heating contractor J. E. Rouillard Enr., and with comparison to similar residences I consider that my consumption of fuel represents 30% economy.



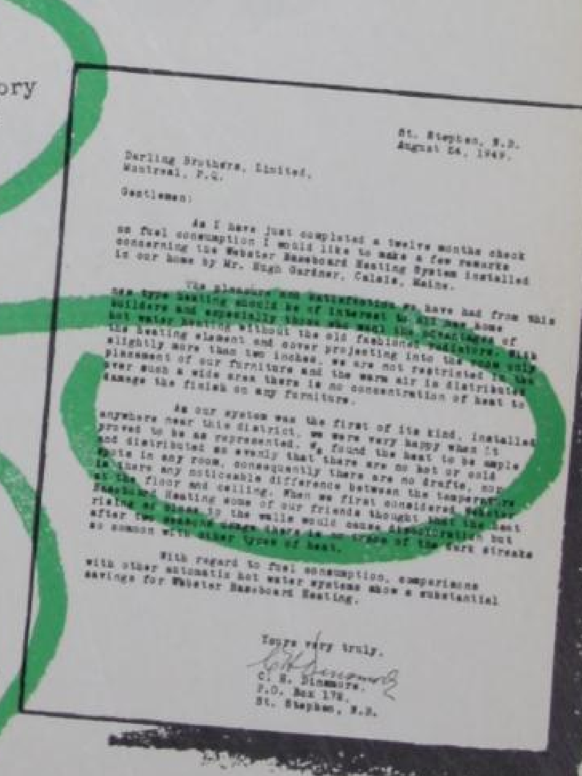
This form of heating was entirely new to me, but since installing same in 1947, I have had an exceptionally even temperature in my rooms. Incidentally, I would mention that my fuel bills with the Central Heating Company have been less for the two past winters than was previously experienced.



BISSON AND SONS

HEARST, ONTARIO

Mr. Charbonneau General Contractor in Hearst, and Mr. Fontaine Lumber Contractor have found the system very satisfactory as to comfort and Fuel consumption. We have had temperature as low as -60. We wish to note that Mr. Fontaine has had an oil burner and Charbonneau a stoker.



The pleasure and satisfaction we have had from this new type heating should be of interest to all new home builders and especially those who want the advantages of hot water heating without the old-fashioned radiators. With the heating element and cover projecting into the room only slightly more than two inches, we are not restricted in the placement of our furniture and the warm air is distributed over such a wide area there is no concentration of heat to damage the finish on any furniture.

As our system was the first of its kind, installed anywhere near this district, we were very happy when it proved to be as represented. We found the heat to be ample and distributed so evenly that there are no hot or cold spots in any room, consequently there are no drafts, nor is there any noticeable difference between the temperature at the floor and ceiling.

*Original letters on file.

BRANCH OFFICES AND REPRESENTATIVES

HALIFAX, N.S.

E. S. Stephenson & Co., Ltd. .... 155 Granville Street

SAINT JOHN, N.B.

E. S. Stephenson & Co., Ltd. .... 15 Dock Street

QUEBEC, P.Q.

W. J. Banks .... 140 St. John Street

ARVIDA, P.Q.

René Beaudet & Cie. Ltée .... 122 Davis Street

TIMMINS, ONT.

Patricia Engineering Ltd. .... 168 Third Ave.

OTTAWA, ONT.

Darling Brothers Limited .... 18 Rideau Street

TORONTO, ONT.

Darling Brothers Limited .... 137 Wellington St. W.

WINNIPEG, MAN.

Darling Brothers Limited .... 123 Princess Street

CALGARY, ALTA.

H. F. Clarke & Co. Ltd. .... 1114 Fifth St. W.

VANCOUVER, B.C.

Frank Darling & Co. Ltd. .... 1144 Homer St.

ST. JOHN'S, NFLD.

Clayton Construction Co. .... 198 Water St.

Darling

CLASS "DG" CENTRIFUGAL PUMPS

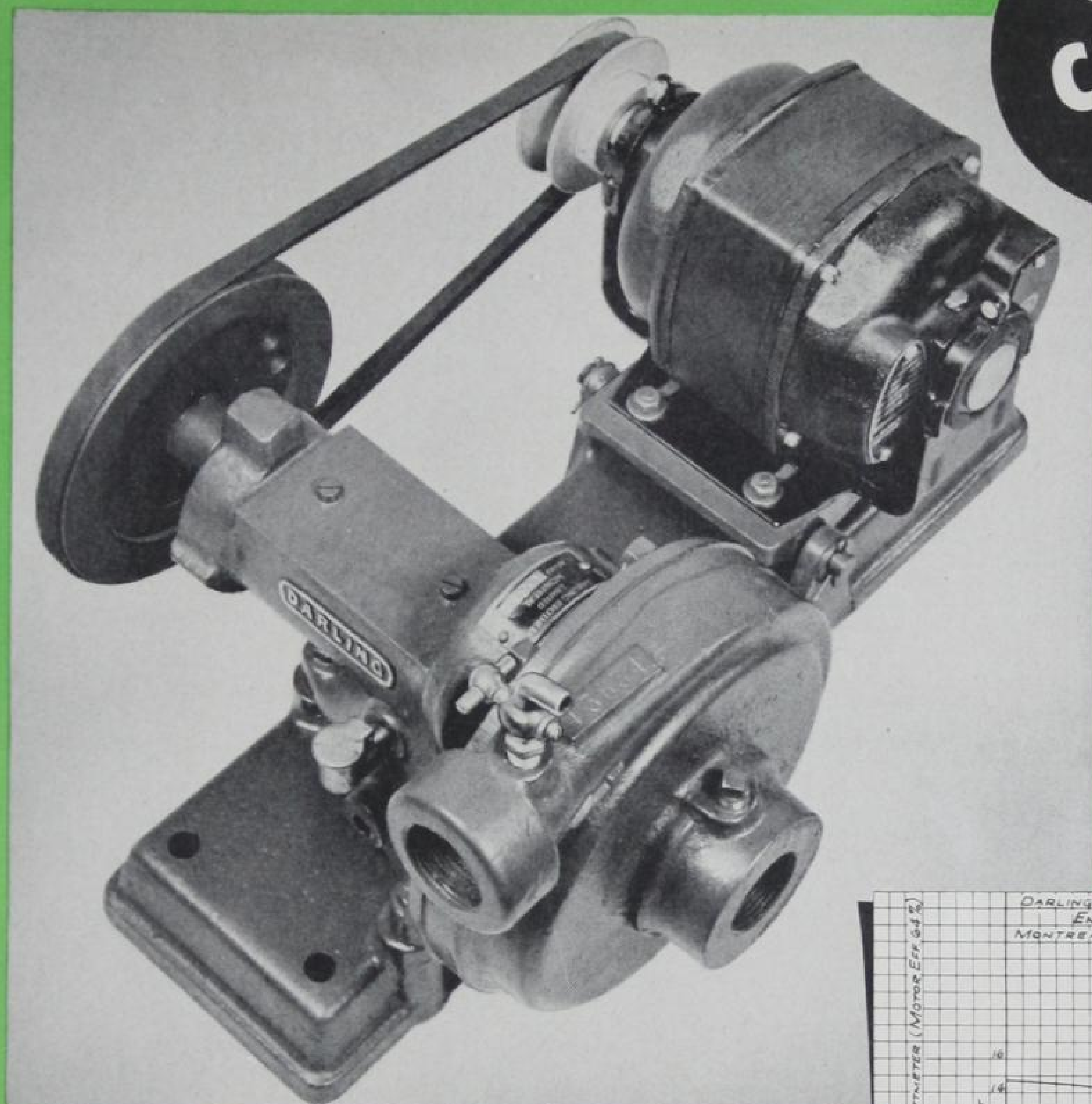


FIG. I. 1¼" x 1¼" Class "DG" Pump V-Belt driven by ⅙ H.P. Split Phase Motor all mounted on C.I. Base. Designed and built to Darling standards.

APPLICATION

Designed primarily for circulating water at low discharge heads such as required in the smaller forced hot water heating systems.

Capacities range from 2 IMP. GPM up to 25 IMP. GPM and heads from 2 ft. to 25 ft. as shown in curves at right. For quietness of operation, with a minimum of attention this unit is ideal.

CAPACITIES

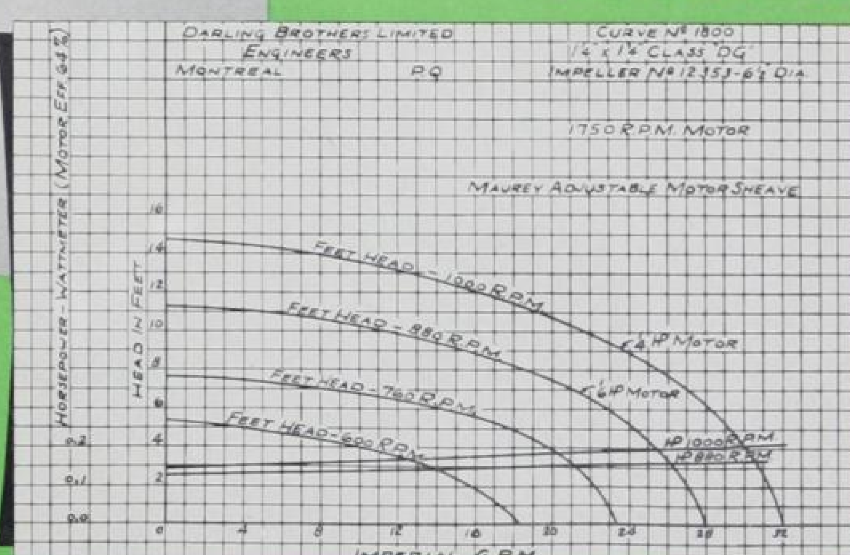


FIG. II

1750 RPM — 60 CYCLE

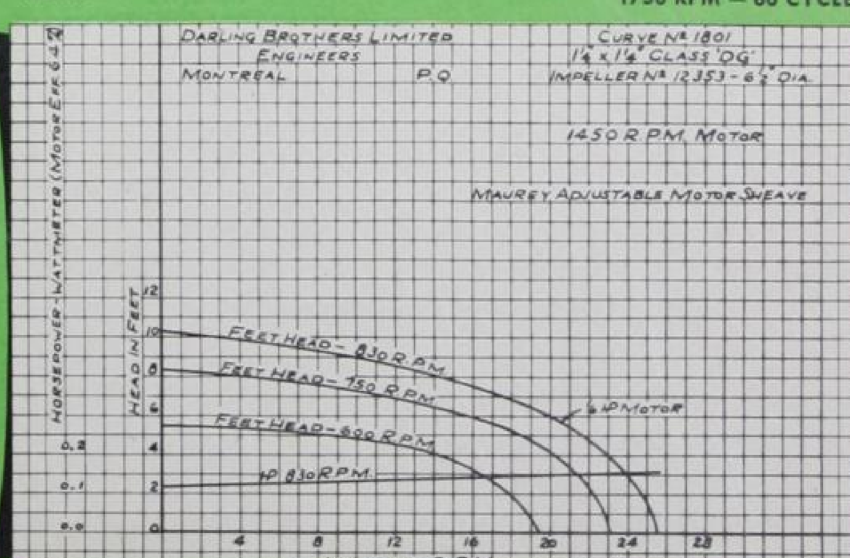


FIG. III

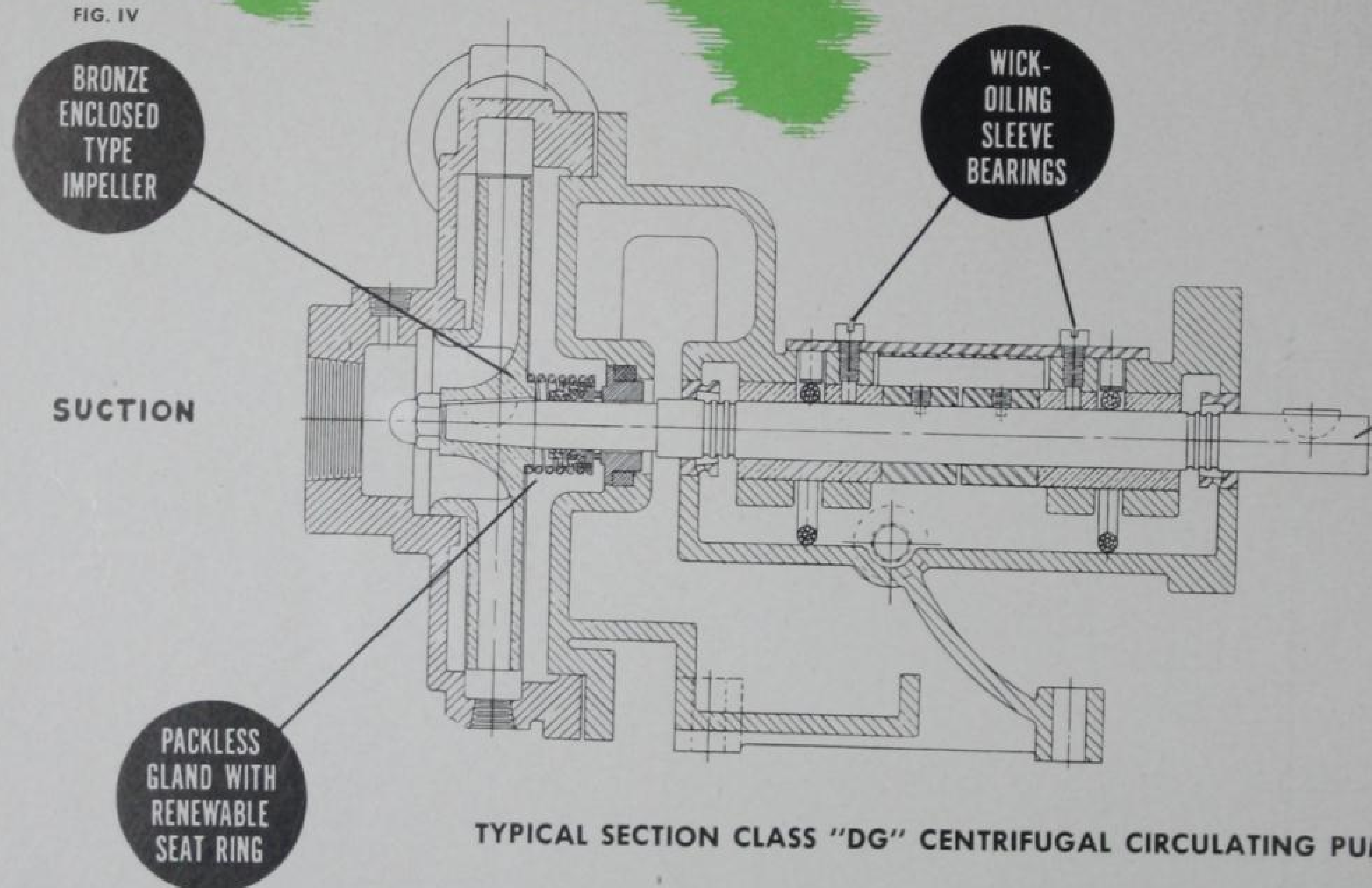
1450 RPM — 25 CYCLE

BULLETIN No. 50

CONSTRUCTION FEATURES

The special features incorporated in the design of this pump ensure quietness of operation and minimum attention. Special features include sleeve bearings, packless gland and isolation of motor from system and building by V-Belt drive and rubber trunnion mounting. Adjustable speed pulley on motor permits running standard pump at different speeds to obtain desired head and capacity.

FIG. IV



TYPICAL SECTION CLASS "DG" CENTRIFUGAL CIRCULATING PUMP

PUMPS FOR EVERY PURPOSE

For land and marine service we design and manufacture Single and Duplex Horizontal and Vertical Steam Pumps for Boiler Feed, Vacuum and Tank Service, also Single and Multistage Centrifugal Pumps for all purposes. Horizontal and Vertical Condensate Pumps.

Since 1888

Darling Brothers Limited

MONTREAL CANADA

ENGINEERS • MANUFACTURERS • FOUNDERS

HALIFAX • SAINT JOHN, N.B. • QUEBEC • ARVIDA

TORONTO • OTTAWA • TIMMINS • WINNIPEG • CALGARY

VANCOUVER • ST. JOHN'S, Nfld.

WEBSTER TYPE N
EXPANSION JOINTS
Internally Guided — Cast Iron

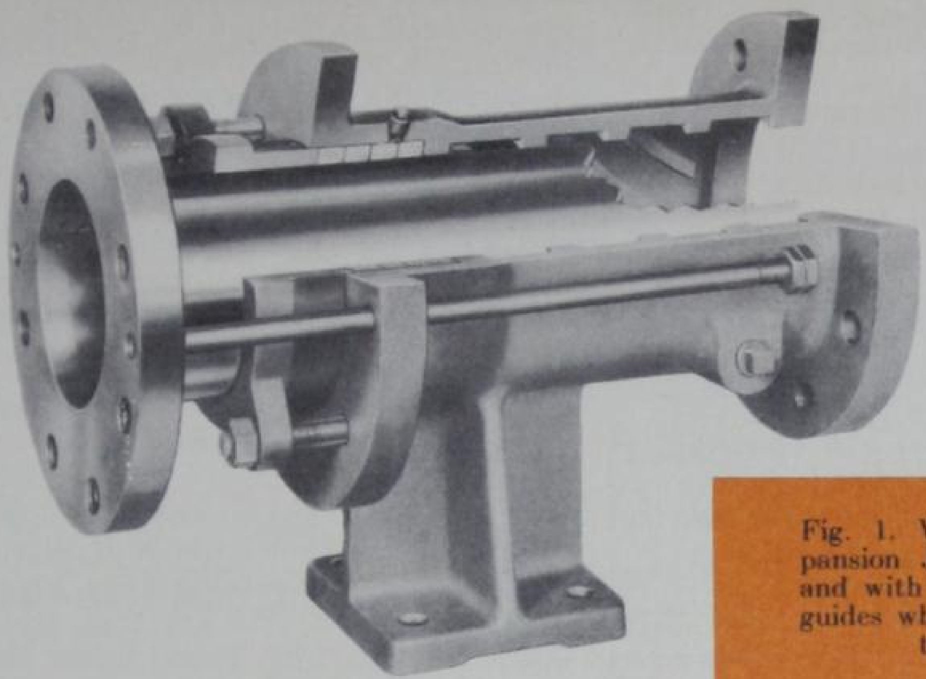


Fig. 1. Webster Single Slip Type N Expansion Joint, Internally Guided, Flanged and with Integral Anchor. Note long spiral guides which keep in contact with slip tube throughout entire traverse.

Webster Type N Expansion Joints are designed to meet specifications calling for an internally guided, cast iron joint. Standard weight models are provided for maximum operating steam pressures up to 125 lb. per sq. in. Extra heavy models are provided for maximum operating steam pressures up to 250 lb. per sq. in. The maximum operating temperature for both standard and extra heavy weight models is 450 degrees F., conforming to the A.S.M.E. Boiler Code.

Application

The fundamental purpose of Webster Expansion Joints is, of course, to take up linear expansion of pipe lines caused by temperature change. The Type N Joint is made especially for those applications where space is limited yet where accurate guiding and alignment are essential. They serve equally well in pipe lines carrying hot oil, hot gas, steam or hot water, and in underground mains and riser lines in buildings.

Design Features

Accurate guiding in the Webster Type N Joint is obtained by four long spiral internal guides which keep in contact with the slip tube throughout the entire traverse. All sizes have heavy anchors integral with the body and designed to withstand full line pressure. Packing space is large and provided with plugged openings into which pressure fittings can later be inserted if Webster Packing Lubricant is to be used. These fittings are not standard equipment. All joints are provided with a plugged drain opening and an internal stop.

Packing glands are easily adjustable by drawing up the nuts of the gland bolts. Limit bolts (tie rods) of ample size prevent the slip and body from coming apart during handling and installation. Pads for service connections are provided on all double slip joints. These pads are drilled and tapped only on special order and at extra cost.

The purchaser of Webster Type N Joints is assured the same high quality as other Webster Equipment resulting from the use of good material, accurate workmanship and careful inspection.

Materials of Construction

Bodies and packing glands are cast iron which is the best obtainable and fully meets specifications

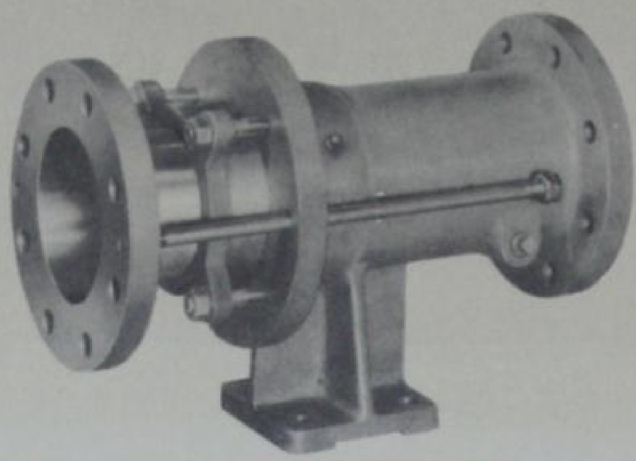


Fig. 2. Webster Single Slip Type N Expansion Joint, Internally Guided, Flanged and with Integral Anchor.

for "semi-steel." Standard slip tubes are of steel, accurately turned, finished smooth and heavily hard-chrome plated. Brass slip tubes can be furnished on special order. Flanges may be either cast iron or steel at our option. Gland bolts and limit bolts are both steel. Webster Standard Packing is furnished suitable for steam and water at pressures stated. Special packing can be provided at extra cost.

Typical Specifications

Expansion joints shall be designed for a maximum working pressure of ...... lb. per sq. in. Bodies shall be cast iron and shall include an integral anchor of ample strength. Slip tubes shall be steel, smoothly finished, and heavily hard-chrome plated. Joints shall be fully guided for the full length of traverse by extra long internal guides cast in a helical form integral with the body of the joint. Packing shall be installed at the factory and suitable for steam (oil) (gas) (water), maximum working pressure of ... lb. per sq. in. and a maximum temperature of ... degrees Fahrenheit. Limit bolts shall be provided to hold body and slip together.

Joints shall be of the single or double type as called for on the plans and designed for a maximum traverse of either 4 inches or 8 inches per slip.

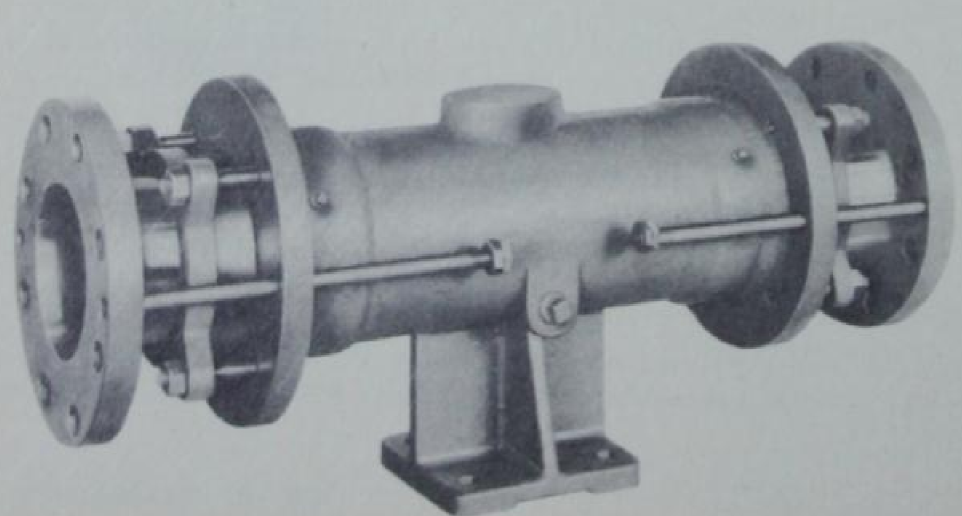


Fig. 3. Webster Double Slip Type N Expansion Joint, Internally Guided, Flanged and with Integral Anchor.

All joints shall be flanged.

Joints shall be Webster Type N Internally Guided or equal, and dimensions shall accord with those in Webster Bulletin B-1103A.

Guarantee

We guarantee Webster Expansion Joints against defects in workmanship and material for a period of one year from date of shipment from our factory but this guarantee will be limited to furnishing new parts in exchange for any that may prove defective within such period, F.O.B. factory, provided the installation has been made and the joints used in accordance with our Service Details and instructions. The guarantee does not include liability for installation costs or contingencies of any character.

Specify STANDARD and Conserve Time and Materials

The sizes available and materials used for **standard** Webster Type N Expansion Joints as described in this catalog have been selected for universal service. We ask that you avoid specifications departing from these standards and incorporating special or non-standard requirements. By so doing you will assist in conserving material and machine time; permit quicker deliveries at lower cost. However, where the proposed use of the expansion joint makes absolutely necessary materials and sizes other than our standard, write us your requirements. We will then tell you if we can make joints to meet them.

Inquiries and Quotations

Inquiries for further information on Webster Expansion Joints and Webster Steam Heating Equipment may be addressed to the Company at Camden, New Jersey, or to the nearest Sales Representative. Look for WARREN WEBSTER & COMPANY in your local telephone book or write us at Camden, New Jersey, for his address. Quotations will be made promptly by our Representatives.

Other Webster Products

We are manufacturers of Webster Process Steam Traps and Strainers (150 lb. maximum pressure), the Webster Moderator and Hylo Steam Heating Controls, and Webster Systems Equipment including radiator supply valves, radiator traps, drip traps, dirt strainers, boiler return traps, vent traps, boiler protectors, light-weight convector radiators, etc. We are also exclusive national distributors of Webster-Nesbitt Unit Heaters. Your inquiries about these products are solicited.

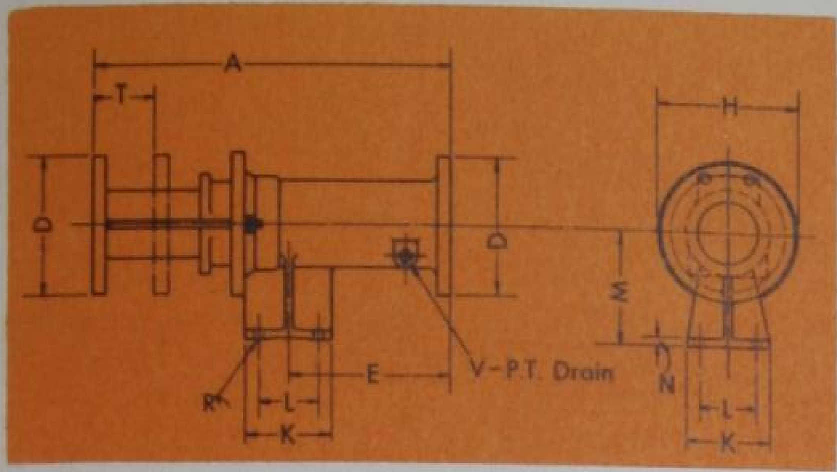


Fig. 4. Single Slip

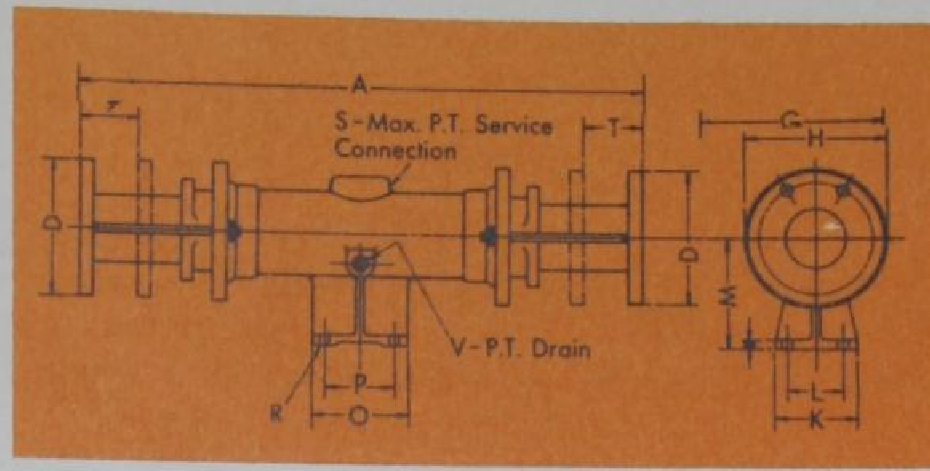


Fig. 5. Double Slip

125 Lb. per Sq. In. Maximum Operating Pressure—450 F. Maximum Operating Temperature.

Table I. STANDARD SINGLE SLIP EXPANSION JOINTS—Dimensions in Inches

Size	T-4" Traverse		T-8" Traverse		D					H	K	L	M	N	R*	V	Approximate Shipping Weight	
	A	E	A	E	Diameter	Thickness	Number and Size of Holes		Bolt Circle								4" Traverse	8" Traverse
1¼	18⅛	6¼	22⅛	8¼	4⅝	½	4	⅝	3½	4⅞	4¼	2½	4½	½	⅝	⅜	20	22
1½	18⅛	6¼	22⅛	8¼	5	9/16	4	⅝	3⅞	5¼	4¼	2½	4⅞	½	⅝	⅜	27	30
2	18¾	6¼	22¾	8¼	6	⅝	4	¾	4¾	6⅛	4½	3	5⅜	½	⅝	⅜	36	40
2½	18¾	6⅛	22¾	8⅛	7	11/16	4	¾	5½	7	4½	3	6	⅝	⅝	⅜	45	53
3	19⅞	6⅜	23⅞	8⅜	7½	¾	4	¾	6	7½	5	3¼	6⅝	⅝	⅝	½	60	65
3½	18⅜	6⅛	24⅜	8⅛	8½	13/16	8	¾	7	8½	5½	3¾	7⅛	⅝	⅝	½	70	80
4	18⅞	6⅜	24⅞	8⅜	9	15/16	8	¾	7½	9¼	5½	3¾	7⅜	⅝	⅝	½	87	100
5	19⅞	6⅝	25⅞	8⅝	10	15/16	8	⅞	8½	10¼	6	4	8⅛	¾	¾	½	100	115
6	21⅜	7¼	27⅜	9¼	11	1	8	⅞	9½	11½	7	5	8¾	¾	⅞	¾	145	160
8	22	7⅛	28	9⅛	13½	1⅛	8	⅞	11¾	14	8	5¾	10¼	⅞	⅞	¾	210	225
10	23½	7⅜	29½	9⅜	16	1 3/16	12	1	14¼	16½	9	6½	12	1	1	1	290	315
12	25⅛	7¾	31⅛	9¾	19	1¼	12	1	17	19¼	10	7	13⅞	1	1⅛	1	390	425

*All anchors drilled with 4 anchor bolt holes size R.
Note—Service connections not available with single slip joints.

Table II. STANDARD DOUBLE SLIP EXPANSION JOINTS—Dimensions in Inches

Size	T-4" Traverse	T-8" Traverse	D					H	K	L	M	N	O	P	R*	S	V	Approximate Shipping Weight	
	A	A	Diameter	Thickness	Number and Size of Holes		Bolt Circle											4" Traverse	8" Traverse
1¼	36¼	44¼	4⅝	½	4	⅝	3½	4⅞	4¼	2½	4½	½	5	3¼	⅝	1	½	35	38
1½	36¼	44¼	5	9/16	4	⅝	3⅞	5¼	4¼	2½	4⅞	½	5	3¼	⅝	1¼	½	47	52
2	37½	45½	6	⅝	4	¾	4¾	6⅛	4½	3	5⅜	½	5½	4	⅝	1½	½	60	70
2½	37½	45½	7	11/16	4	¾	5½	7	4½	3	6	⅝	5½	4	⅝	2	½	70	80
3	39¾	47¾	7½	¾	4	¾	6	7½	5	3¼	6⅝	⅝	6	4¼	⅝	2	¾	90	100
3½	36¾	48¾	8½	13/16	8	¾	7	8½	5½	3¾	7⅛	⅝	6½	4¾	⅝	2	¾	120	140
4	37¾	49¾	9	15/16	8	¾	7½	9¼	5½	3¾	7⅜	⅝	6½	4¾	⅝	2½	¾	140	167
5	39¾	51¾	10	15/16	8	⅞	8½	10¼	6	4	8⅛	¾	7	5	¾	2½	¾	166	190
6	42¾	54¾	11	1	8	⅞	9½	11½	7	5	8¾	¾	8	6	⅞	2½	1	245	270
8	44	56	13½	1⅛	8	⅞	11¾	14	8	5¾	10¼	⅞	9	6¾	⅞	3	1	350	385
10	47	59	16	1 3/16	12	1	14¼	16½	9	6½	12	1	10	7½	1	3	1	485	535
12	50¼	62¼	19	1¼	12	1	17	19¼	10	7	13⅞	1	11	8	1⅛	3	1	645	720

*All anchors drilled with 4 anchor bolt holes size R.
Note—Service connection pad is drilled and tapped when specified only and at extra cost. No change in dimension A.

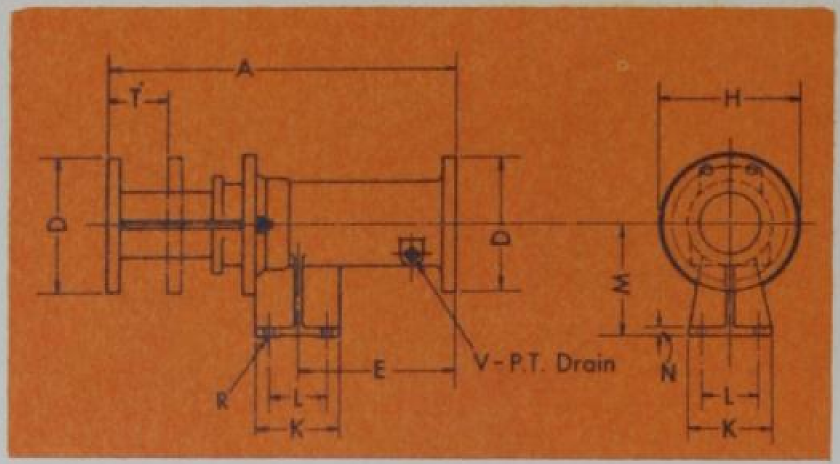


Fig. 6. Single Slip

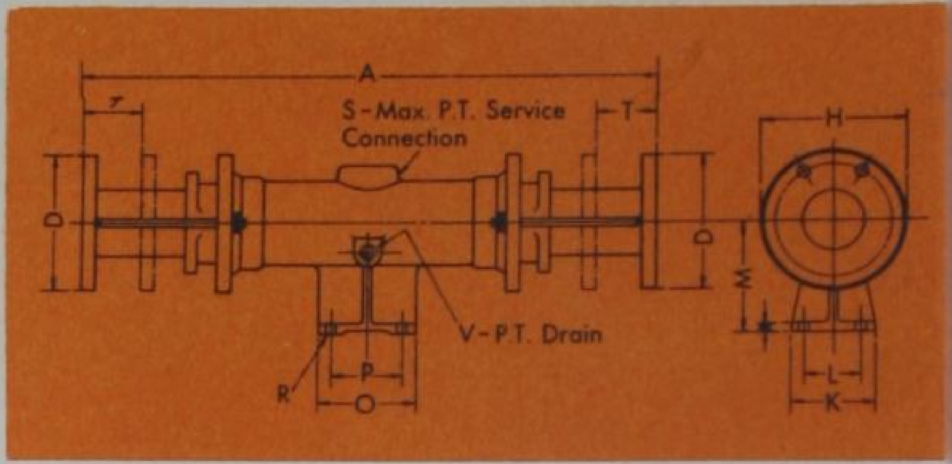


Fig. 7. Double Slip

250 Lb. per Sq. In. Maximum Operating Pressure—450° F. Maximum Operating Temperature

Table III. EXTRA HEAVY SINGLE SLIP EXPANSION JOINTS—Dimensions in Inches

Size	T-4″ Traverse		T-8″ Traverse		D					H	K	L	M	N	R*	V	Approximate Shipping Weight	
	A	E	A	E	Diameter	Thickness	Number and Size of Holes		Bolt Circle								4″ Traverse	8″ Traverse
1½	17¾	6½	23¾	8½	6⅛	13/16	4	⅞	4½	6⅛	4½	3	5¾	⅝	⅝	⅜	43	45
2	17¾	6⅜	23¾	8⅜	6½	⅞	8	¾	5	6¾	4¾	3¼	6	⅝	⅝	⅜	54	58
2½	18⅜	6⅝	24⅜	8⅝	7½	1	8	⅞	5⅞	7⅝	5	3½	6⅞	¾	⅝	⅜	76	81
3	18⅞	6½	24⅞	8½	8¼	1⅛	8	⅞	6⅝	8¼	5½	4	7¼	¾	⅝	½	100	107
3½	20	6⅝	26	8⅝	9	13/16	8	⅞	7¼	9¼	6	4¼	7¾	¾	¾	½	121	130
4	20⅝	7¼	26⅝	9¼	10	1¼	8	⅞	7⅞	10⅛	6	4¼	8¼	¾	¾	½	144	157
5	21¾	7½	27¾	9½	11	1⅜	8	⅞	9¼	11	7	5	9	⅞	⅞	½	186	203
6	22⅞	7⅝	28⅞	9⅝	12½	17/16	12	⅞	10⅝	12⅞	7½	5½	9¾	⅞	⅞	¾	250	275
8	24¼	7⅝	30¼	9⅝	15	1⅝	12	1	13	15½	9	6¾	11¼	1	1	¾	340	370
10	26¼	8¼	32¼	10¼	17½	1⅞	16	1⅛	15¼	18⅛	10	7¾	13	1⅛	1	1	525	565
12	27¼	8⅜	33¼	10⅜	20½	2	16	1¼	17¾	21	11	8½	14⅞	1⅛	1⅛	1	670	730

*All anchors drilled with 4 anchor bolt holes size R.
Note—Service connections not available with single slip joints.

Table IV. EXTRA HEAVY DOUBLE SLIP EXPANSION JOINTS—Dimensions in Inches

Size	T-4″ Traverse	T-8″ Traverse	D					H	K	L	M	N	O	P	R*	S	V	Approximate Shipping Weight	
	A	A	Diameter	Thickness	Number and Size of Holes		Bolt Circle											4″ Traverse	8″ Traverse
1½	35½	47½	6⅛	13/16	4	⅞	4½	6⅛	4½	3	5¾	⅝	5½	4	⅝	1¼	½	74	78
2	35½	47½	6½	⅞	8	¾	5	6¾	4¾	3¼	6	⅝	5¾	4¼	⅝	1½	½	93	102
2½	36¾	48¾	7½	1	8	⅞	5⅞	7⅝	5	3½	6⅞	¾	6	4½	⅝	2	½	130	138
3	37¾	49¾	8¼	1⅛	8	⅞	6⅝	8¼	5½	4	7¼	¾	6½	5	⅝	2	¾	168	185
3½	40	52	9	13/16	8	⅞	7¼	9¼	6	4¼	7¾	¾	7	5¼	¾	2	¾	205	225
4	41¼	53¼	10	1¼	8	⅞	7⅞	10⅛	6	4¼	8¼	¾	7	5¼	¾	2½	¾	240	270
5	43½	55½	11	1⅜	8	⅞	9¼	11	7	5	9	⅞	8	6	⅞	2½	¾	310	340
6	45¾	57¾	12½	17/16	12	⅞	10⅝	12⅞	7½	5½	9¾	⅞	8½	6½	⅞	2½	1	425	470
8	48½	60½	15	1⅝	12	1	13	15½	9	6¾	11¼	1	10	7¾	1	3	1	565	625
10	52½	64½	17½	1⅞	16	1⅛	15¼	18⅛	10	7¾	13	1⅛	11	8¾	1	3	1	880	960
12	54½	66½	20½	2	16	1¼	17¾	21	11	8½	14⅞	1⅛	12	9½	1⅛	3	1	1100	1220

*All anchors drilled with 4 anchor bolt holes size R.
Note—Service connection pad is drilled and tapped when specified only and at extra cost. No change in dimension A.

WARREN WEBSTER & COMPANY · CAMDEN, NEW JERSEY

Form No. C-611A. 2-5 2 5M. Printed in U.S.A.

WEBSTER TYPE C

EXPANSION JOINTS

Crosshead Guided — Cast Iron

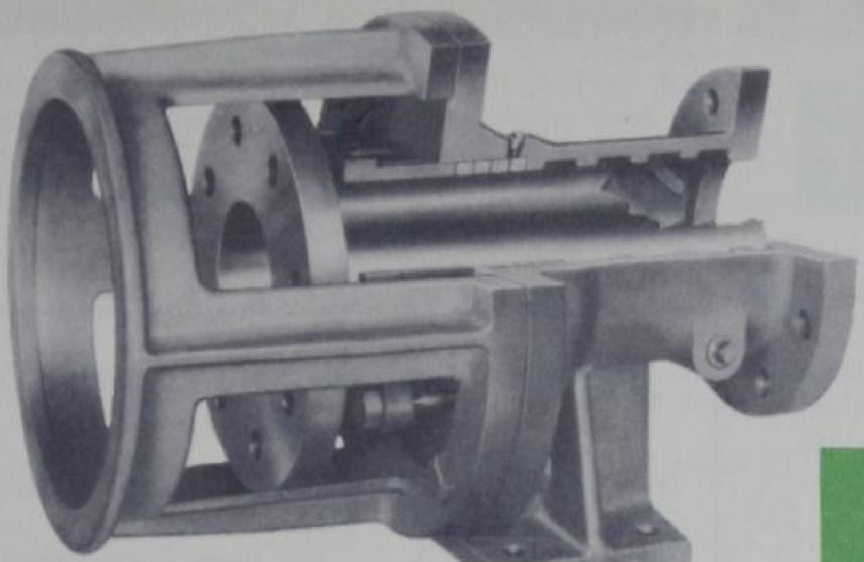


Fig. 1. Webster Single Slip Type C Expansion Joint, Crosshead Guided, Flanged and with Integral Anchor. Note strong crosshead and long spiral internal guides which keep in contact with slip tube throughout entire traverse.

Specifications calling for both *internally and externally* guided, cast iron joints are met by the Webster Type C Expansion Joints. Standard weight models are provided for maximum operating steam pressures up to 125 lb. per sq. in. Extra heavy models are provided for maximum operating steam pressures up to 250 lbs. per sq. in. The maximum operating temperature for both standard and extra heavy weight models is 450 degrees F., conforming to the A.S.M.E. Boiler Code.

Application

The fundamental purpose of all Webster Expansion Joints is, of course, to take up linear expansion of pipe lines caused by temperature change. The Type C Joint is designed for universal service yet gives unusual accuracy of alignment because of the two-point guiding. These joints serve equally well in pipe lines carrying hot oil, hot gas, steam or hot water.

Design Features

The external guiding feature is a machined crosshead which has four contact surfaces with the flange of the slip tube. Type C Joints include stops which limit travel in both directions and prevent the slip tube from separating from the body. Internal guiding is obtained by four long spiral guides which keep in contact with the slip tube throughout the entire traverse. All sizes have heavy anchors cast integral with the body.

Packing space is large and provided with plugged openings into which a pressure fitting can later be inserted if Webster Packing Lubricant is to be used. These fittings are not standard equipment. Packing glands are easily adjustable by drawing up the nuts of the gland bolts. All joints are provided with a plugged drain opening.

Pads for service connections are provided on all double slip joints. These pads are drilled and tapped only on special order and at extra cost.

The purchaser of Type C Joints is assured the same high quality as other Webster Equipment resulting from the use of good material, accurate workmanship, and careful inspection.

Materials of Construction

Bodies, crossheads, and packing glands are cast iron which is the best obtainable and fully meets specifications for "semi-steel." Standard slip tubes

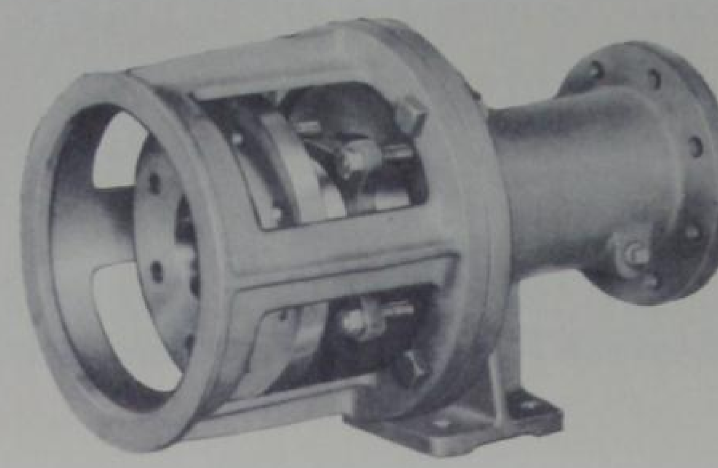


Fig. 2. Webster Single Slip Type C Expansion Joint, Crosshead Guided, Flanged and with Integral Anchor.

are of steel, accurately turned, finished smooth, and heavily hard-chrome plated. Brass slip tubes can be furnished on special order. Flanges are cast iron. Gland bolts are steel. Webster Standard Packing is furnished suitable for steam and water at pressures stated. Special packing can be provided at extra cost.

Typical Specifications

Expansion joints shall be designed for a maximum working pressure of ...... lb. per sq. in. Bodies shall be cast iron and shall include an integral anchor of ample strength. Slip tubes shall be steel, smoothly finished, and heavily hard-chrome plated. Joints shall be fully guided for the full length of traverse by a machined external crosshead guide and by extra long internal guides cast in a helical form integral with the body of the joint. Packing shall be installed at the factory and suitable for steam (oil) (gas) (water), maximum working pressure of ... lb. per sq. in. and a maximum temperature of ... degrees Fahrenheit. Limit stops shall be provided to prevent excessive travel of the joint.

Joints shall be of the single or double type as called for on the plans and designed for a maximum traverse of either 4 inches or 8 inches per slip.

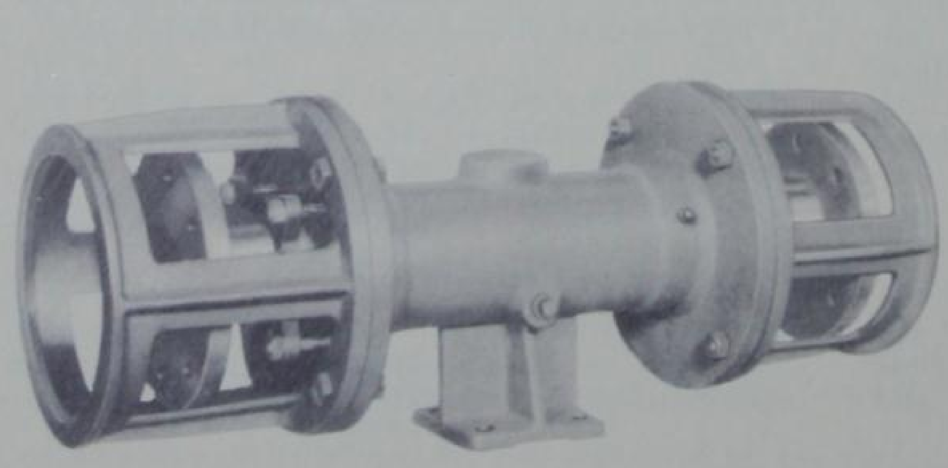


Fig. 3. Webster Double Slip Type C Expansion Joint, Crosshead Guided, Flanged and with Integral Anchor.

All joints shall be flanged.

Joints shall be Webster Type C Crosshead Guided or equal, and dimensions shall accord with those in Webster Bulletin B-1101A.

Guarantee

We guarantee Webster Expansion Joints against defects in workmanship and material for a period of one year from date of shipment from our factory but this guarantee will be limited to furnishing new parts in exchange for any that may prove defective within such period, F.O.B. factory, provided the installation has been made and the joints used in accordance with our Service Details and instructions. The guarantee does not include liability for installation costs or contingencies of any character.

Specify STANDARD and Conserve Time and Materials

The sizes available and materials used for **standard** Webster Type C Expansion Joints as described in this catalog have been selected for universal service. We ask that you avoid specifications departing from these standards and incorporating special or non-standard requirements. By so doing you will assist in conserving material and machine time; permit quicker deliveries at lower cost. However, where the proposed use of the expansion joint makes absolutely necessary materials and sizes other than our standard, write us your requirements. We will then tell you if we can make joints to meet them.

Inquiries and Quotations

Inquiries for further information on Webster Expansion Joints and Webster Steam Heating Equipment may be addressed to the Company at Camden, New Jersey, or to the nearest Sales Representative. Look for WARREN WEBSTER & COMPANY in your local telephone book or write us at Camden, New Jersey, for his address. Quotations will be made promptly by our Representatives.

Other Webster Products

We are manufacturers of Webster Process Steam Traps and Strainers (150 lb. maximum pressure), the Webster Moderator and Hylo Steam Heating Controls, and Webster Systems Equipment including radiator supply valves, radiator traps, drip traps, dirt strainers, boiler return traps, vent traps, boiler protectors, light-weight convector radiators, etc. We are also exclusive national distributors of Webster-Nesbitt Unit Heaters. Your inquiries about these products are solicited.

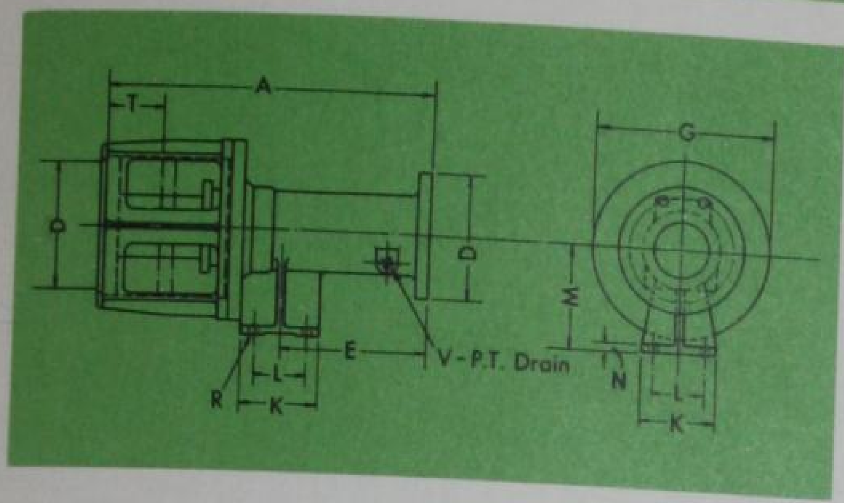


Fig. 4. Single Slip

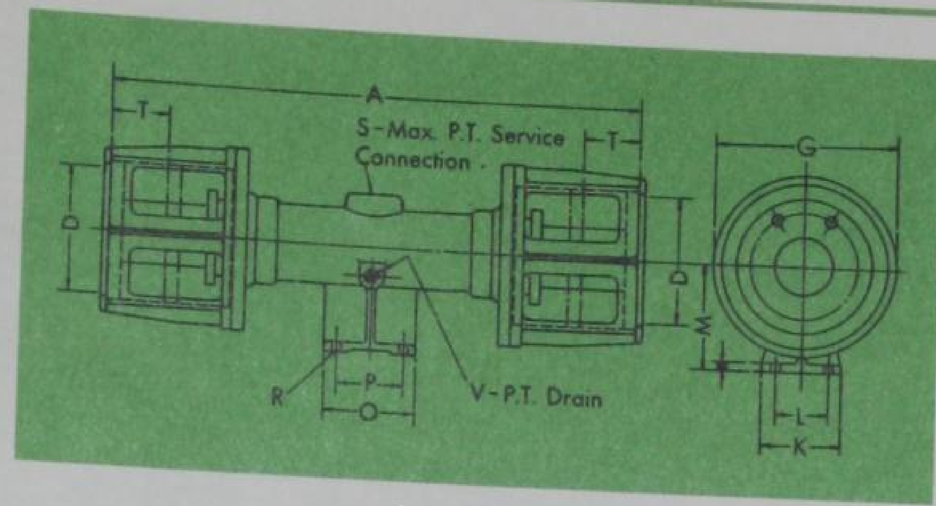


Fig. 5. Double Slip

125 Lb. per Sq. In. Maximum Operating Pressure—450° F. Maximum Operating Temperature.

Table I. STANDARD SINGLE SLIP EXPANSION JOINTS—Dimensions in Inches

Size	T-4" Traverse		T-8" Traverse		D					G	K	L	M	N	R*	V	Approximate Shipping Weight	
	A	E	A	E	Diameter	Thickness	Number and Size of Holes		Bolt Circle								4" Traverse	8" Traverse
1¼	18⅛	8¼	22⅛	8¼	4⅝	½	4	⅝	3½	7½	4¼	2½	4½	½	⅝	⅜	36	42
1½	18⅛	8¼	22⅛	8¼	5	9/16	4	⅝	3⅞	8	4¼	2½	4⅞	½	⅝	⅜	45	52
2	18¾	8¼	22¾	8¼	6	⅝	4	¾	4¾	9¼	4½	3	5⅜	½	⅝	⅜	60	65
2½	18¾	8⅛	22¾	8⅛	7	11/16	4	¾	5½	10¼	4½	3	6	⅝	⅝	⅜	75	85
3	19⅞	8⅜	23⅞	8⅜	7½	¾	4	¾	6	11¼	5	3¼	6⅝	⅝	⅝	½	95	130
3½	18⅜	6⅛	24⅜	8⅛	8½	13/16	8	¾	7	12¼	5½	3¾	7⅛	⅝	⅝	½	115	140
4	18⅞	6⅜	24⅞	8⅜	9	15/16	8	¾	7½	12¾	5½	3¾	7⅜	⅝	⅝	½	135	160
5	19⅞	6⅝	25⅞	8⅝	10	15/16	8	⅞	8½	13¾	6	4	8⅛	¾	¾	½	145	175
6	21⅜	7¼	27⅜	9¼	11	1	8	⅞	9½	14¾	7	5	8¾	¾	⅞	¾	210	230
8	22	7⅛	28	9⅛	13½	1⅛	8	⅞	11¾	17¼	8	5¾	10¼	⅞	⅞	¾	320	345
10	23½	7⅜	29½	9⅜	16	1 3/16	12	1	14¼	20¾	9	6½	12	1	1	1	415	450
12	25⅛	7¾	31⅛	9¾	19	1¼	12	1	17	24	10	7	13⅞	1	1⅛	1	585	640

*All anchors drilled with 4 anchor bolt holes size R.
Note—Service connections not available with single slip joints.

Table II. STANDARD DOUBLE SLIP EXPANSION JOINTS—Dimensions in Inches

Size	T-4" Traverse	T-8" Traverse	D					G	K	L	M	N	O	P	R*	S	V	Approximate Shipping Weight	
	A	A	Diameter	Thickness	Number and Size of Holes		Bolt Circle											4" Traverse	8" Traverse
1¼	36¼	44¼	4⅝	½	4	⅝	3½	7½	4¼	2½	4½	½	5	3¼	⅝	1	½	71	80
1½	36¼	44¼	5	9/16	4	⅝	3⅞	8	4¼	2½	4⅞	½	5	3¼	⅝	1¼	½	87	97
2	37½	45½	6	⅝	4	¾	4¾	9¼	4½	3	5⅜	½	5½	4	⅝	1½	½	112	120
2½	37½	45½	7	11/16	4	¾	5½	10¼	4½	3	6	⅝	5½	4	⅝	2	½	136	155
3	39¾	47¾	7½	¾	4	¾	6	11¼	5	3¼	6⅝	⅝	6	4¼	⅝	2	¾	170	200
3½	36¾	48¾	8½	13/16	8	¾	7	12¼	5½	3¾	7⅛	⅝	6½	4¾	⅝	2	¾	202	220
4	37¾	49¾	9	15/16	8	¾	7½	12¾	5½	3¾	7⅜	⅝	6½	4¾	⅝	2½	¾	235	255
5	39¾	51¾	10	15/16	8	⅞	8½	13¾	6	4	8⅛	¾	7	5	¾	2½	¾	245	270
6	42¾	54¾	11	1	8	⅞	9½	14¾	7	5	8¾	¾	8	6	⅞	2½	1	420	460
8	44	56	13½	1⅛	8	⅞	11¾	17¼	8	5¾	10¼	⅞	9	6¾	⅞	3	1	595	645
10	47	59	16	1 3/16	12	1	14¼	20¾	9	6½	12	1	10	7½	1	3	1	770	835
12	50¼	62¼	19	1¼	12	1	17	24	10	7	13⅞	1	11	8	1⅛	3	1	1090	1190

*All anchors drilled with 4 anchor bolt holes size R.
Note—Service connection pad is drilled and tapped when specified only and at extra cost. No change in dimension A.

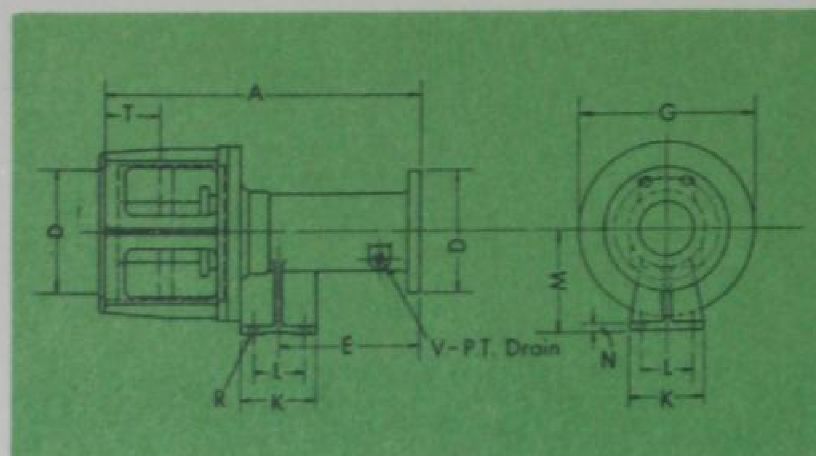


Fig. 6. Single Slip

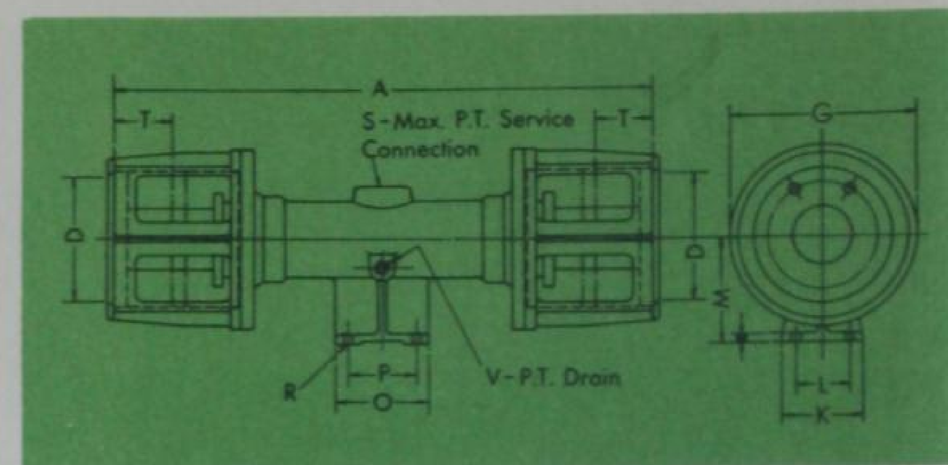


Fig. 7. Double Slip

250 Lb. per Sq. In. Maximum Operating Pressure—450° F. Maximum Operating Temperature.

Table III. EXTRA HEAVY SINGLE SLIP EXPANSION JOINTS—Dimensions in Inches

Size	T-4″ Traverse		T-8″ Traverse		D					G	K	L	M	N	R*	V	Approximate Shipping Weight	
	A	E	A	E	Diameter	Thickness	Number and Size of Holes		Bolt Circle								4″ Traverse	8″ Traverse
1½	17¾	6½	23¾	8½	6⅛	13/16	4	⅞	4½	9⅜	4½	3	5¾	⅝	⅝	⅜	72	77
2	17¾	6⅜	23¾	8⅜	6½	⅞	8	¾	5	9¾	4¾	3¼	6	⅝	⅝	⅜	104	108
2½	18⅜	6⅝	24⅜	8⅝	7½	1	8	⅞	5⅞	11¼	5	3½	6⅞	¾	⅝	⅜	126	140
3	18⅞	6½	24⅞	8½	8¼	1⅛	8	⅞	6⅝	12	5½	4	7¼	¾	⅝	½	158	170
3½	20	6⅝	26	8⅝	9	1 3/16	8	⅞	7¼	12¾	6	4¼	7¾	¾	¾	½	190	210
4	20⅝	7¼	26⅝	9¼	10	1¼	8	⅞	7⅞	13¾	6	4¼	8¼	¾	¾	½	220	245
5	21¾	7½	27¾	9½	11	1⅜	8	⅞	9¼	14¾	7	5	9	⅞	⅞	½	250	275
6	22⅞	7⅝	28⅞	9⅝	12½	1 7/16	12	⅞	10⅝	16¼	7½	5½	9¾	⅞	⅞	¾	325	355
8	24¼	7⅝	30¼	9⅝	15	1⅝	12	1	13	18¾	9	6¾	11¼	1	1	¾	405	445
10	26¼	8¼	32¼	10¼	17½	1⅞	16	1⅛	15¼	22⅛	10	7¾	13	1⅛	1	1	560	610
12	27¼	8⅜	33¼	10⅜	20½	2	16	1¼	17¾	25⅝	11	8½	14⅞	1⅛	1⅛	1	745	810

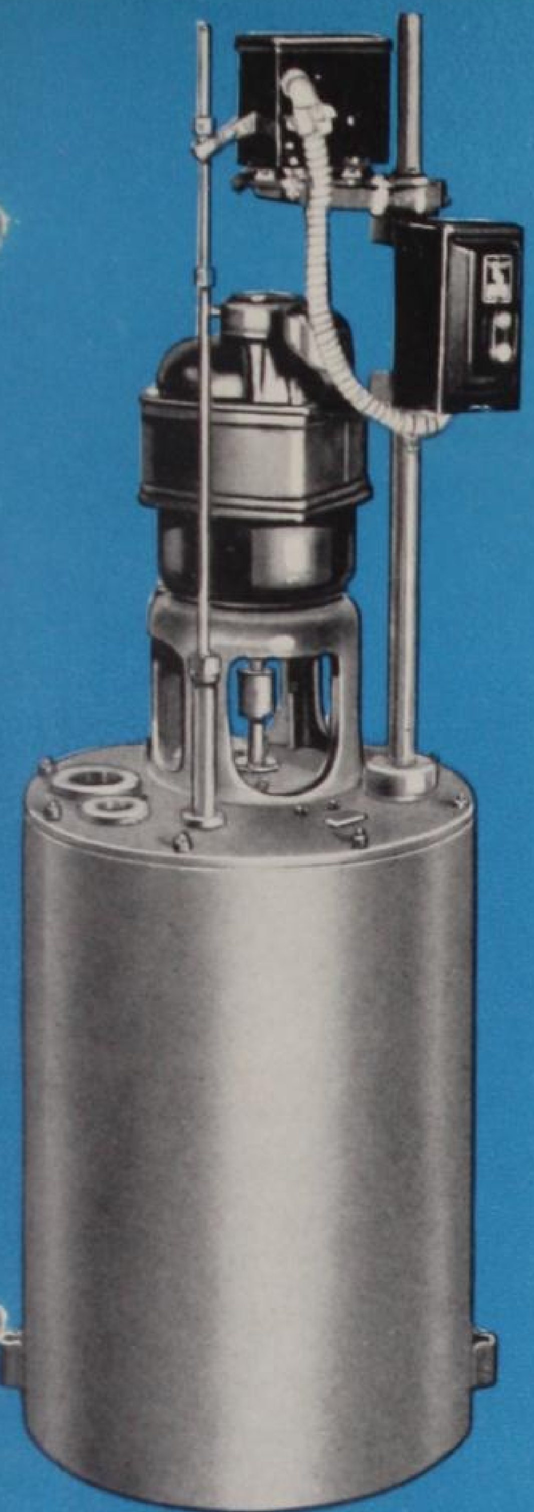
*All anchors drilled with 4 anchor bolt holes size R.
Note—Service connections not available with single slip joints.

Table IV. EXTRA HEAVY DOUBLE SLIP EXPANSION JOINTS—Dimensions in Inches

Size	T-4″ Traverse	T-8″ Traverse	D					G	K	L	M	N	O	P	R*	S	V	Approximate Shipping Weight	
	A	A	Diameter	Thickness	Number and Size of Holes		Bolt Circle											4″ Traverse	8″ Traverse
1½	35½	47½	6⅛	13/16	4	⅞	4½	9⅜	4½	3	5¾	⅝	5½	4	⅝	1¼	½	133	143
2	35½	47½	6½	⅞	8	¾	5	9¾	4¾	3¼	6	⅝	5¾	4¼	⅝	1½	½	195	205
2½	36¾	48¾	7½	1	8	⅞	5⅞	11¼	5	3½	6⅞	¾	6	4½	⅝	2	½	235	260
3	37¾	49¾	8¼	1⅛	8	⅞	6⅝	12	5½	4	7¼	¾	6½	5	⅝	2	¾	290	320
3½	40	52	9	1 3/16	8	⅞	7¼	12¾	6	4¼	7¾	¾	7	5¼	¾	2	¾	345	385
4	41¼	53¼	10	1¼	8	⅞	7⅞	13¾	6	4¼	8¼	¾	7	5¼	¾	2½	¾	420	445
5	43½	55½	11	1⅜	8	⅞	9¼	14¾	7	5	9	⅞	8	6	⅞	2½	¾	450	500
6	45¾	57¾	12½	1 7/16	12	⅞	10⅝	16¼	7½	5½	9¾	⅞	8½	6½	⅞	2½	1	610	650
8	48½	60½	15	1⅝	12	1	13	18¾	9	6¾	11¼	1	10	7¾	1	3	1	685	790
10	52½	64½	17½	1⅞	16	1⅛	15¼	22⅛	10	7¾	13	1⅛	11	8¾	1	3	1	975	1070
12	54½	66½	20½	2	16	1¼	17¾	25⅝	11	8½	14⅞	1⅛	12	9½	1⅛	3	1	1290	1420

*All anchors drilled with 4 anchor bolt holes size R.
Note—Service connection pad is drilled and tapped when specified only and at extra cost. No change in dimension A.

Form No. C-614B, 11-50, 5M, JM, Printed in U. S. A.



The Darling VC Pump is designed and built for long service under the exacting conditions required for returning condensate from heating systems and process steam equipment to boiler or hot well. The Receiver may be installed on the floor or in a pit for returns from above or below the floor level. A product of over 60 years' experience in pump design and manufacture by Darling Brothers Limited.

Darling

IMPROVED

Automatic Electric VERTICAL CONDENSATION RETURN PUMP

Type VC

Outstanding Features

- ★ Within its range of capacities, the Darling VC pump, engineered for the job, offers new design features for economy and long life.
- ★ Unusually high efficiencies are obtained with reduced motor sizes and operating costs.
- ★ Designed to prevent vapor binding and to handle condensation at high temperatures.
- ★ A new and improved type of enclosed impeller increases efficiency.
- ★ Efficient hydraulic and mechanical balance contributes to high performance standards.
- ★ New submerged shaft bearing, self-lubricating, non-metallic type for high temperature condensate service.

Darling Brothers Limited

140 PRINCE ST. *Since 1888* MONTREAL

Halifax · Saint John · Quebec · Arvida · Ottawa · Toronto
Timmins · Winnipeg · Calgary · Vancouver · St. John's, Nfld.

Pioneers in Canadian Pump Design and Manufacture

Darling AUTOMATIC ELECTRIC VERTICAL CONDENSATION RETURN PUMP

Ruggedly Built Yet Easily Dismounted

Heavily constructed to withstand sustained service demands, the Darling VC Pump consists of a vertical centrifugal pump suspended by a heavy column from a cast iron base on which a vertical electric motor is mounted. The base forms the cover of the cylindrical Receiver. To facilitate dismounting and reassembly, the pump is constructed independently of the Receiver so that it can be lifted out simply by disconnecting the piping and electrical connections. The pump and motor components are located in position by machined spigots. Correct alignment is thus assured on reassembly.

Improved Pump Unit

The submerged Centrifugal pump is fitted with an improved design of bronze enclosed type impeller for increased efficiency. The impeller is secured by Key and Bronze locknut to tapered stainless steel shaft, polished to a mirror finish. The shaft is supported at the submerged end by a recently developed self-lubricating non-metallic bearing capable of operating at high condensate temperatures, with longer pump life and reduced maintenance.

Heavy Steel Receiver

The Receiver is of welded steel construction, with reinforced openings for pipe connections. A condensing seal prevents the escape of vapor at the cover. Piping connections between pump and receiver cover and electric wiring connections between the automatic float switch, thermal protection unit and motor, are built into the unit.

Thermal Protection

The Darling VC Pump is powered with standard makes of vertical motors mounted on a combination bearing housing and motor support. Single phase motors are of the repulsion induction type; polyphase motors are of squirrel cage design, while shunt type motors can be supplied for direct current. All types are equipped with self-lubricating ball bearings and provided with thermal protection.

Automatic Control

A quick make and break heavy duty butt contact switch mounted above the Receiver cover is actuated by a heavy gauge seamless copper float in the Receiver and a rod equipped with adjustable stops for changes in start and stop water levels, which can be quickly made.

Tested Under Operating Conditions

Thorough tests on all pump units manufactured by Darling are made for capacities, pressures and horsepower. Electric current of commercial frequencies and voltages is available at all times to the Testing Department so that pumps may be driven by their own motors, ensuring careful tests and inspection during actual operation.

Warranty

All goods supplied by Darling Brothers Limited are subject to a guarantee, which is limited to furnishing f.o.b. our works such parts as prove defective in material and workmanship within one year from date of shipment.

TYPICAL SPECIFICATION FORM FOR DARLING TYPE VC CONDENSATION RETURN UNITS

Furnish and install where indicated on plans .... Type VC Darling Automatic Electric Vertical Condensation Return Pump and Receiver, for returning condensate to hot well or boiler. Pump to have a capacity of .... U.S. gallons per minute against a pressure of .... pounds per square inch at pump discharge. Receiver to be .... in diameter by .... in height.

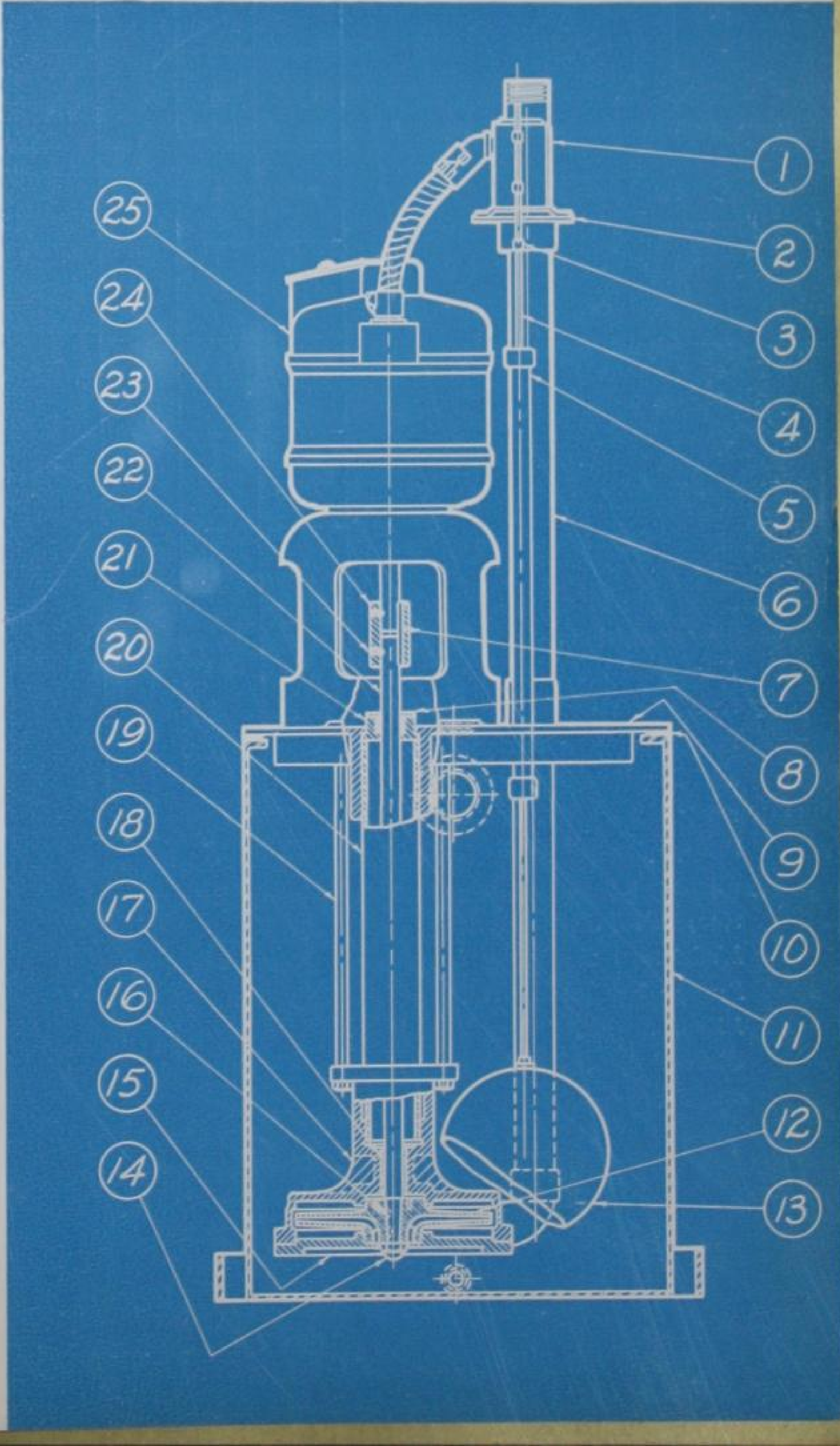
The unit shall consist of a steel receiver and a single suction vertical centrifugal pump, suspended by a column from the receiver cover. A vertical electric motor shall be mounted on a stool cast integrally with the cover, together with the motor control unit and thermal protective device. Pump to be furnished with bronze enclosed impeller secured by bronze locknut on keyed and tapered end of stainless steel shaft. Submerged shaft bearing to be of the non-metallic self-lubricating type for high temperature Condensate service. All parts of the pump are to be positively located in position by spigots and shoulders.

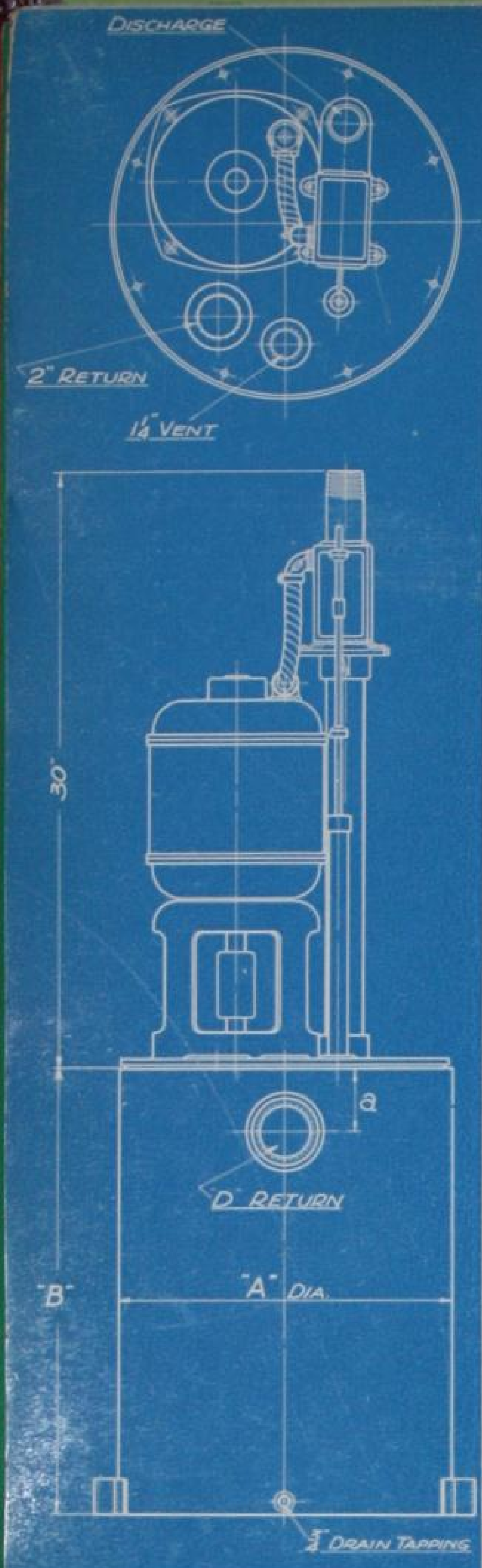
Motor to be .... H.P. .... R.P.M. .... Phase .... Cycle .... Volt, continuous rating. The automatic control to be a totally enclosed heavy duty butt contact float switch actuated by an extra heavy seamless copper float and a rod equipped with adjustable stops for changes in start and stop water levels.

All piping connections between pump and receiver cover and electric wiring connections between the automatic float switch, thermal protection unit and motor, shall be supplied and installed on the pump by Darling Brothers Limited.

• PARTS LIST •

1—Float Switch.
2—Float Switch Stand.
3—Limit Stops.
4—Float Rod.
5—Float Rod Guide and Condensing Seal
6—Discharge Pipe.
7—Coupling Key.
8—Gland.
9—Base and Receiver Cover.
10—Gasket for Receiver.
11—Receiver.
12—Impeller.
13—Float.
14—Shaft Nut.
15—Pump Cover.
16—Impeller Key.
17—Pump Casing.
18—Non-metallic Pump Bushing.
19—Tie Rods.
20—Pipe Column.
21—Stuffing Box.
22—Stainless Steel Pump Shaft.
23—Dog Pointed Set Screws.
24—Shaft Coupling.
25—Motor.





Darling PUMPS

for long Life and Service

Type VC

Vertical Condensation Return Pumps

DIMENSIONS • CAPACITIES • RATINGS

CAPACITY		Discharge Pressure Lbs. per Sq. In.	Symbol	*60 CYCLES—1750 R.P.M.				*25 CYCLES—1450 R.P.M.				Size Discharge Ins.	Size Inlet "D" Ins.	Dimension "a" Ins.
					RECEIVER				RECEIVER					
Sq. Ft. E.D.R.	U.S. Gals. per Min.			Motor H.P.	Diam. Ins. "A"	Height Ins. "B"	Shipping Wt. Lbs.	Motor H.P.	Diam. Ins. "A"	Height Ins. "B"	Shipping Wt. Lbs.			
4,000	6	10	4-V-10	⅓	18	18	300	⅓	18	18	320	1	2	3⅛
		15	4-V-15	⅓	18	18	300	⅓	18	18	320	1	2	3⅛
		20	4-V-20	½	18	18	320	½	18	18	340	1	2	3⅛
		25	4-V-25	¾	18	18	360	¾	26	18	390	1	2	3⅛
		30	4-V-30	1	18	18	410	1	26	18	450	1	2	3⅛
6,000	9	10	6-V-10	⅓	18	18	300	⅓	18	18	320	1	2	3⅛
		15	6-V-15	⅓	18	18	300	½	18	18	320	1	2	3⅛
		20	6-V-20	½	18	18	320	½	18	18	340	1	2	3⅛
		25	6-V-25	¾	18	18	360	¾	26	18	390	1	2	3⅛
		30	6-V-30	1	18	18	410	1	26	18	450	1	2	3⅛
8,000	12	10	8-V-10	⅓	20	24	310	⅓	20	24	330	1	2	3⅛
		15	8-V-15	½	20	24	330	½	20	24	350	1	2	3⅛
		20	8-V-20	½	20	24	330	½	20	24	350	1	2	3⅛
		25	8-V-25	¾	20	24	370	¾	26	18	400	1	2	3⅛
		30	8-V-30	1	20	24	420	1	26	18	460	1	2	3⅛
10,000	15	10	10-V-10	⅓	20	24	310	⅓	20	24	330	1¼	2½	3¼
		15	10-V-15	½	20	24	330	½	20	24	350	1	2½	3¼
		20	10-V-20	½	20	24	330	¾	20	24	400	1	2½	3¼
		25	10-V-25	¾	20	24	370	¾	26	18	400	1	2½	3¼
		30	10-V-30	1	20	24	420	1	26	18	460	1	2½	3¼
15,000	22½	10	15-V-10	½	24	24	340	½	26	24	360	1¼	3	3¾
		15	15-V-15	½	24	24	340	¾	26	24	410	1¼	3	3¾
		20	15-V-20	¾	24	24	380	¾	26	24	410	1¼	3	3¾
		25	15-V-25	1	24	24	430	1	26	24	470	1¼	3	3¾
		30	15-V-30	1½	24	24	500	1½	26	24	560	1	3	3¾
20,000	30	10	20-V-10	½	24	24	340	½	26	24	360	1¼	3	3¾
		15	20-V-15	¾	24	24	380	¾	26	24	410	1¼	3	3¾
		20	20-V-20	1	24	24	430	1	26	24	410	1¼	3	3¾
		25	20-V-25	1	24	24	430	1	26	24	470	1¼	3	3¾
		30	20-V-30	1½	24	24	500	1½	26	24	560	1¼	3	3¾
25,000	37½	10	25-V-10	½	24	36	420	½	26	36	440	1¼	4	4¼
		15	25-V-15	¾	24	36	460	¾	26	36	490	1¼	4	4¼
		20	25-V-20	1	24	36	510	1	26	36	550	1¼	4	4¼
		25	25-V-25	1½	24	36	580	1½	26	36	640	1¼	4	4¼
		30	25-V-30	1½	24	36	580	1½	26	36	640	1¼	4	4¼
30,000	45	10	30-V-10	½	24	36	420	½	26	36	440	1½	4	4¼
		15	30-V-15	¾	24	36	460	¾	26	36	490	1¼	4	4¼
		20	30-V-20	1	24	36	510	1	26	36	550	1¼	4	4¼
		25	30-V-25	1½	24	36	580	1½	26	36	640	1¼	4	4¼
		30	30-V-30	1½	24	36	580	1½	26	36	640	1¼	4	4¼

Larger Sizes Available

***When ordering, state electric current available.**

Pumps for Every Purpose

For land and marine service we design and manufacture Single and Duplex Horizontal and Vertical Steam Pumps for Boiler Feed, Vacuum and Tank Service; also Single and Multistage Centrifugal Pumps for Condensate, Bilge, Sump, Sewage, Circulating, Vacuum and Process work.

DESCRIPTIVE LITERATURE ON REQUEST

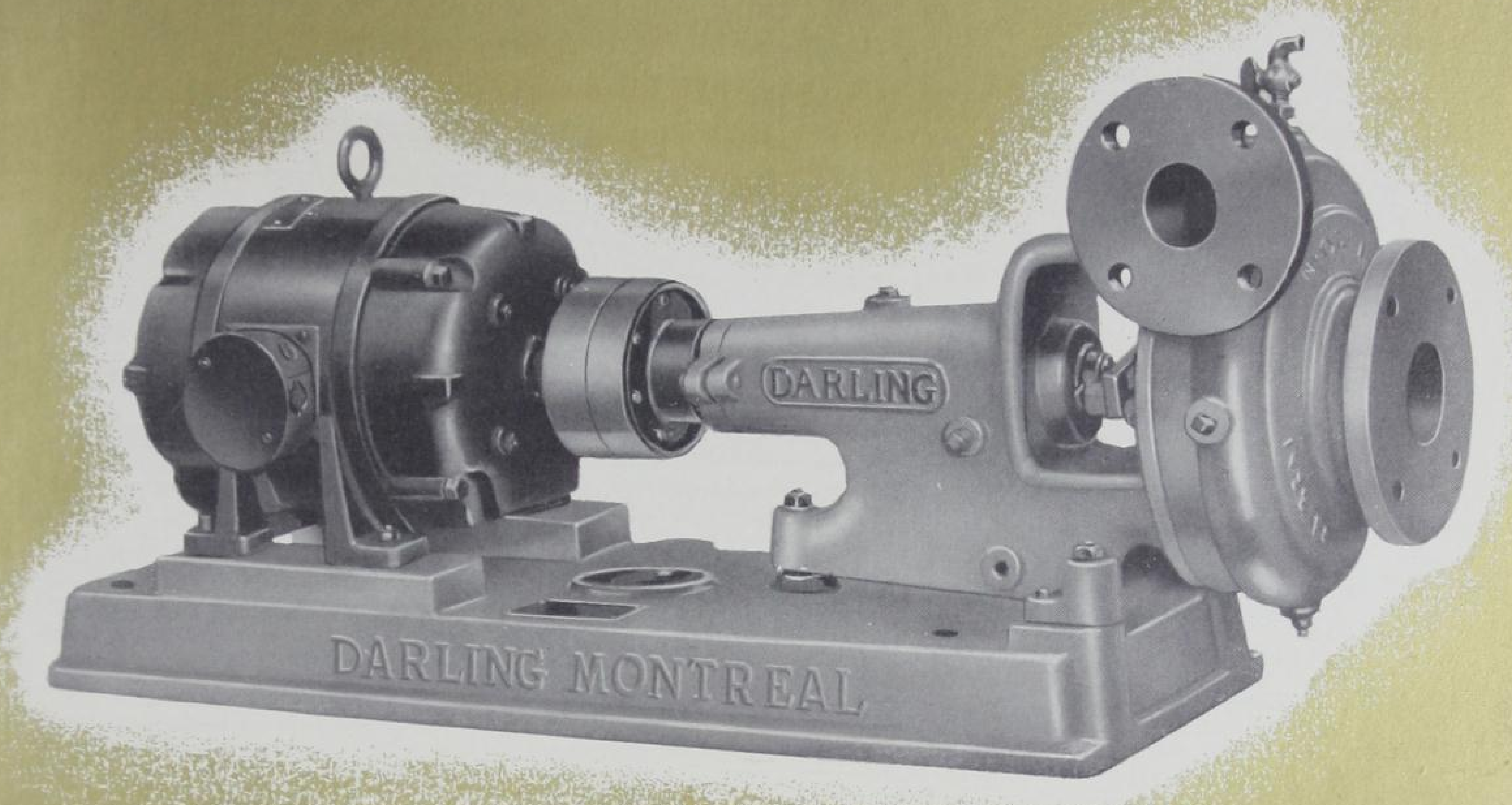
Darling Brothers Limited

Head Office and Plants

MONTREAL

Printed in Canada-CE-BF-1949

Since 1888



DARLING

Since 1888

CLASS "D"

END SUCTION

CENTRIFUGAL PUMPS

ENGINEERING DEPARTMENT

Pumps of every type and capacity take shape on these draughting boards. Skilled draughtsmen design equipment to suit the individual requirements of every client. New modifications are under constant review, and continuous improvement is the byword.

PATTERN SHOP

Experience gained by over sixty years of pattern making gives this department a "know how" unique in the business. Constant high standards are maintained by men who know patterns thoroughly. From these intricate patterns come the fine castings from which famous Darling pumps are made.

Darling Plant Views

Our Guarantee

We guarantee all pumps made by us against defects in materials and workmanship for one year from date of shipment from our factory. Any part which should prove defectvie within that period must be returned to our factory all charges full prepaid. We will then make such part good without any additional compensation.

This guarantee is only effective when equipment has been set up according to our instructions.

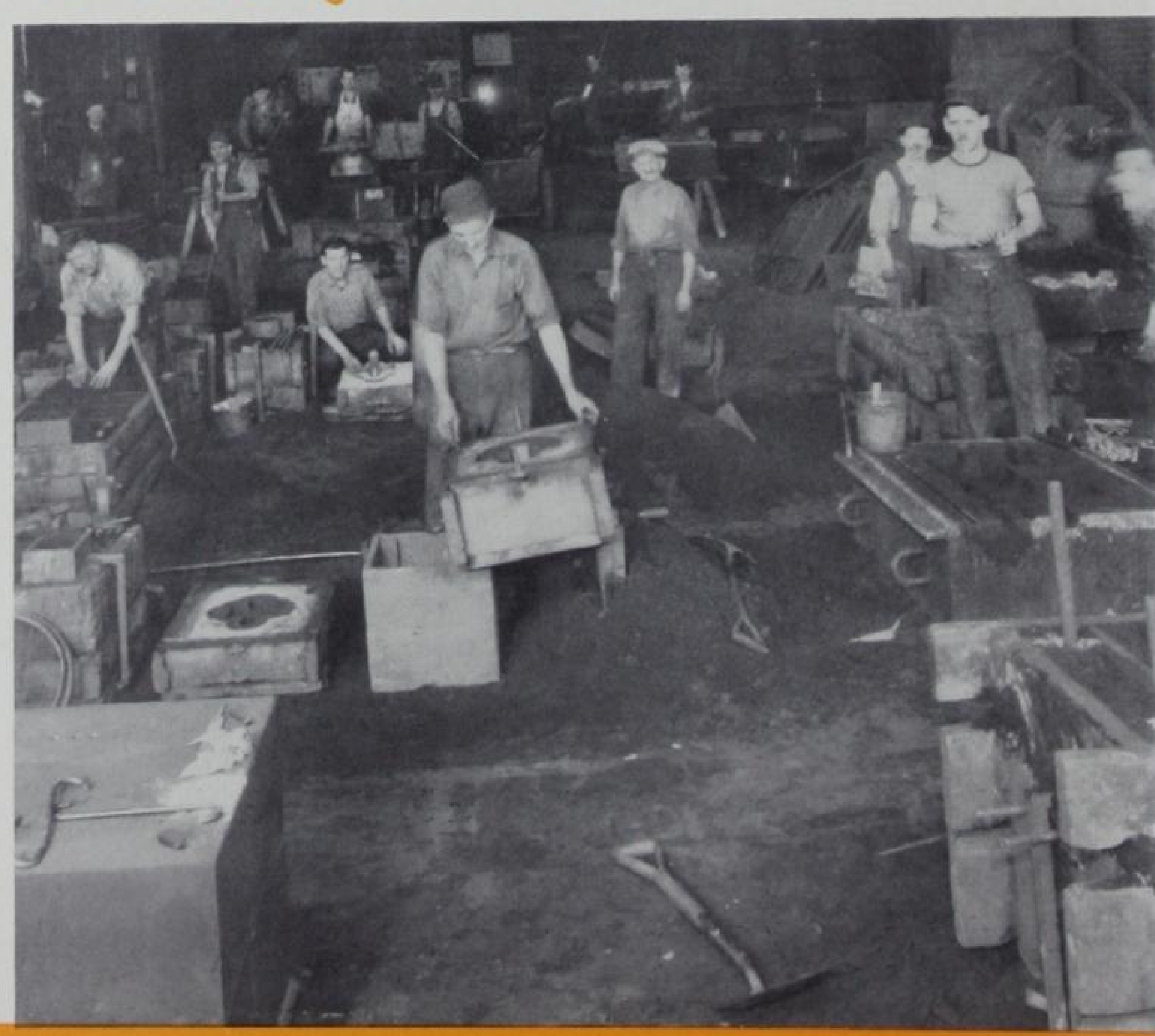
Our guarantee does not cover any of our equipment which has been altered or repaired outside of our factory, or motors, electrical appliances or auxiliaries not manufactured by us.

All our pumps are carefully inspected and thoroughly tested before leaving our factory. If they are properly connected and adjusted they will be satisfactory in operation.

All parts are made interchangeable. Duplicate parts carried in stock and can be shipped promptly.

FOUNDRY

More than molten metals are poured into the moulds in our foundry. High grade materials, long years of experience, pride and craftsmanship are some of the ingredients which flow from the cupola into these fine castings; rugged enough to take the kind of wear Darling pumps are famous for.



PUMP ASSEMBLY

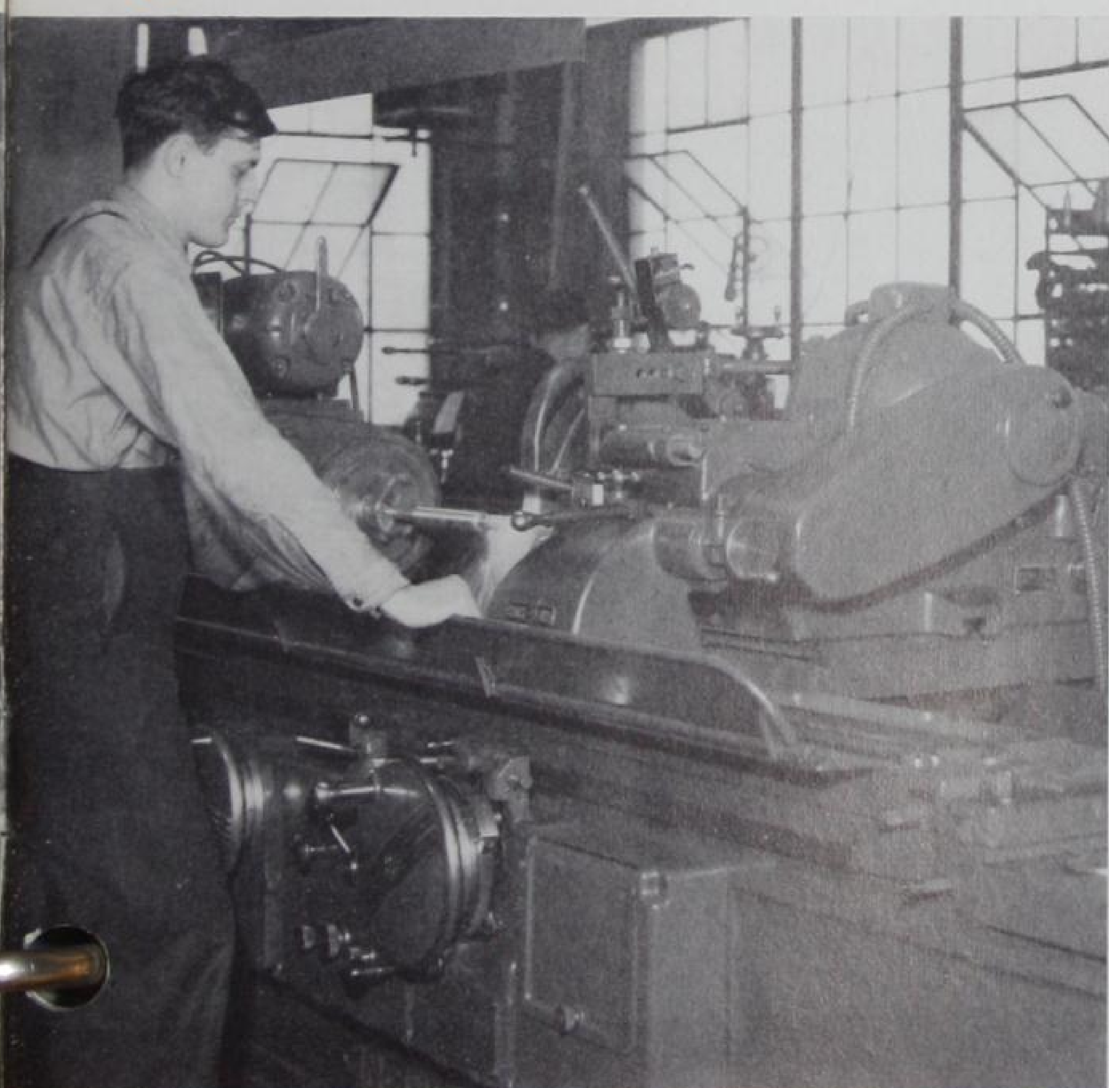
Here skilled fitters assemble the component parts of every pump. One of our most modern departments, pump assembly takes great pride and care in this important operation, the last step before the complete pump is tested for shipment.

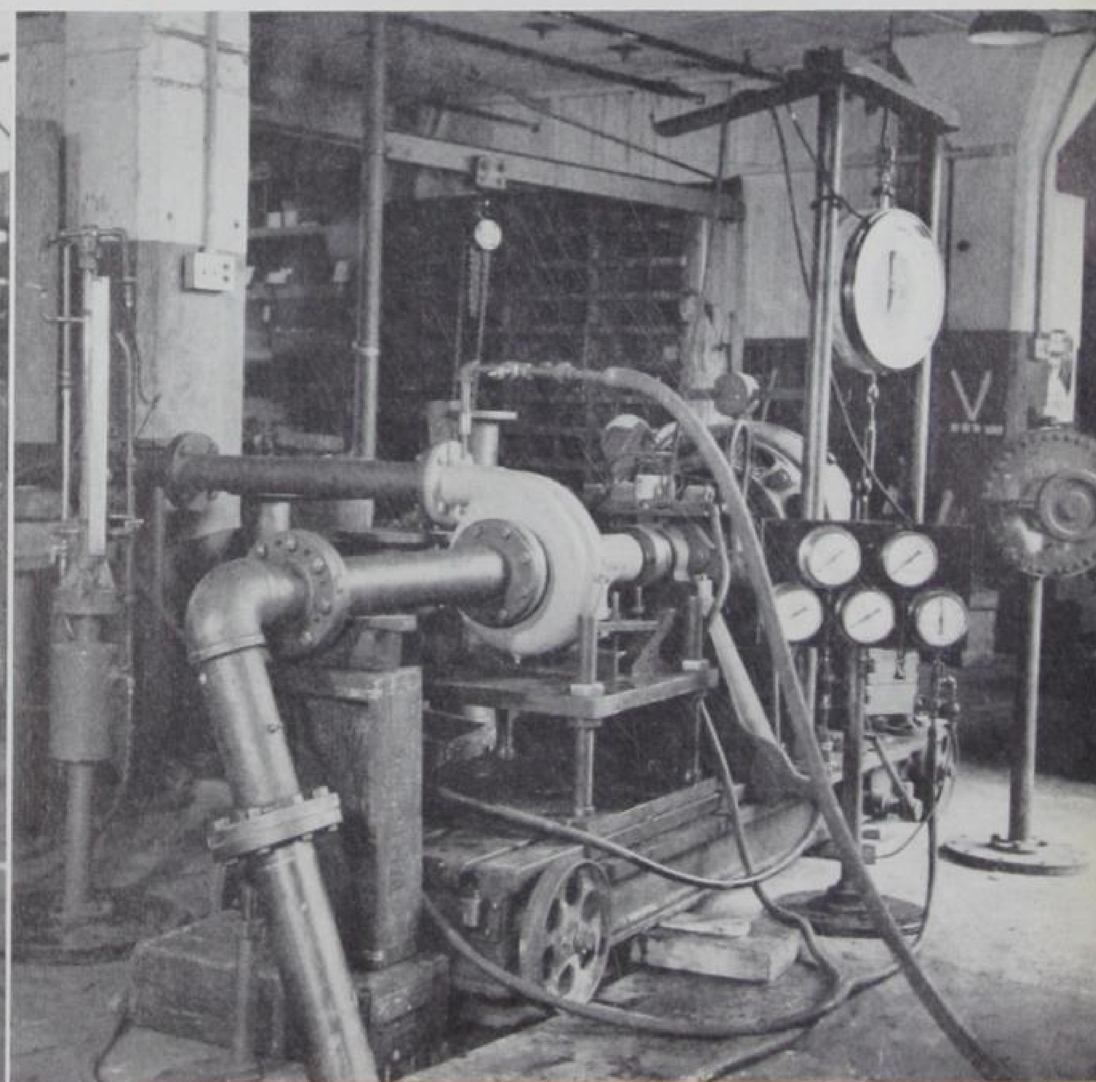
MACHINE SHOP

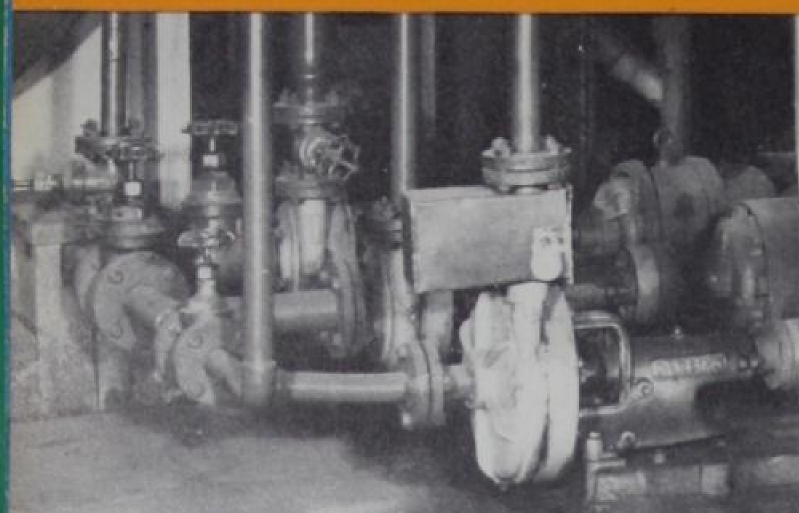
A prime factor in the enviable reputation of Darling pumps is the consumate skill of the master craftsmen in our machine shop. Modern machine tools enable these machinists to turn out consistant high quality workmanship. Part of the secret of this consistency is the infinite care taken in every operation, one of the reasons why the famous Darling ingot stamp of quality stands in such high esteem.

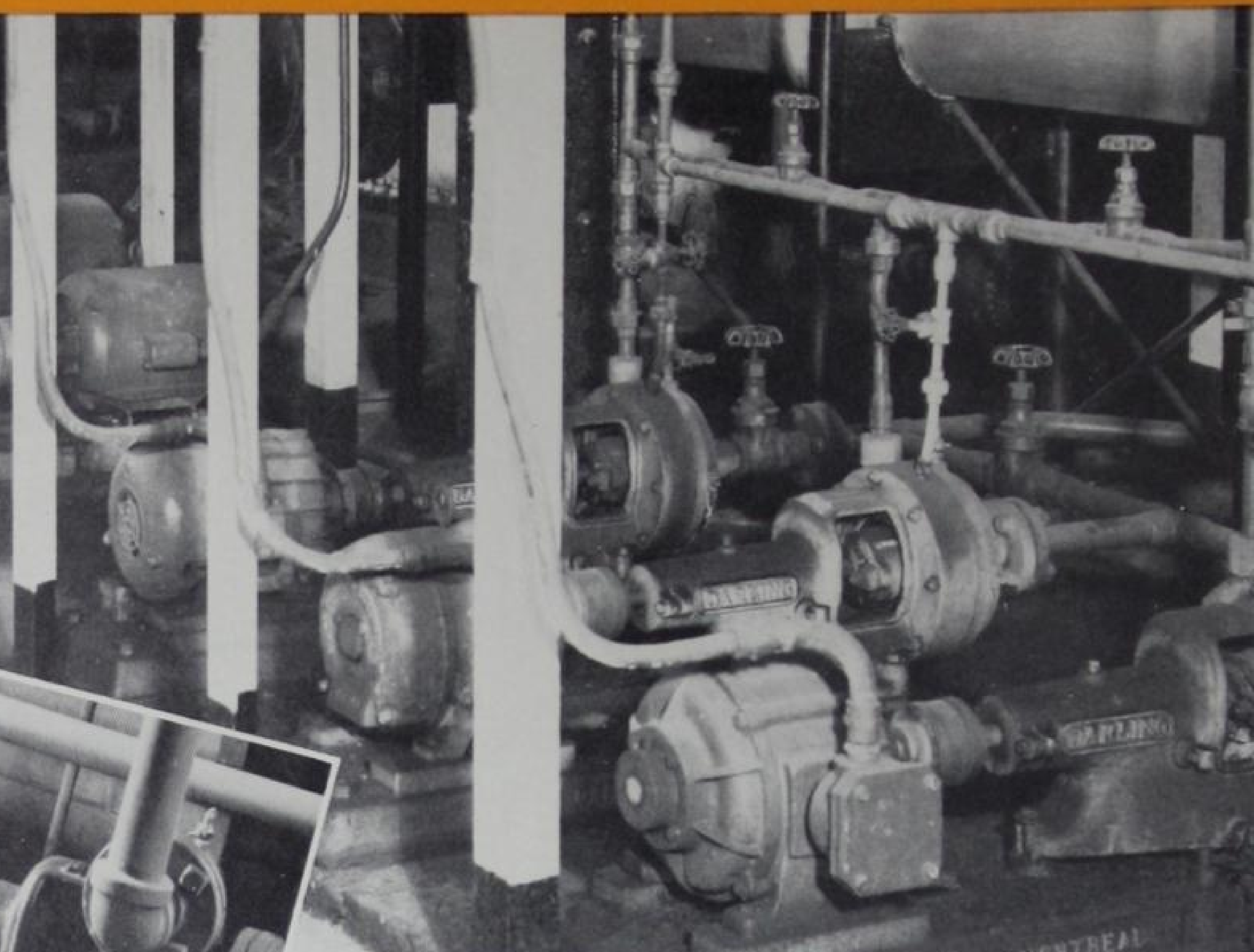
TESTING DEPARTMENT

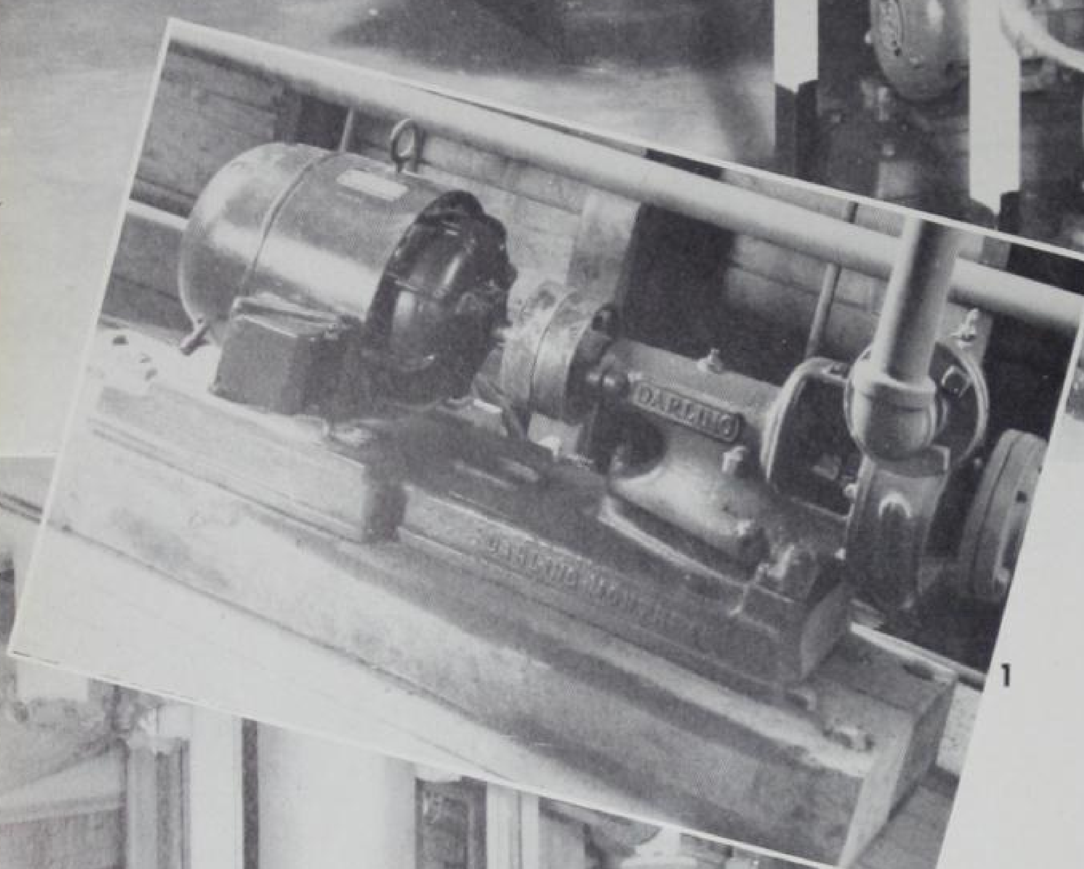
Every pump manufactured by Darling Brothers is put through its paces in the testing department. Rigorous pressure and running tests to simulate field conditions are conducted here. Only one standard is accepted in this department — efficient operation — only then are the pumps shipped carrying the seal of approval, the famous Darling ingot stamp, denoting top performance under the most exacting conditions.







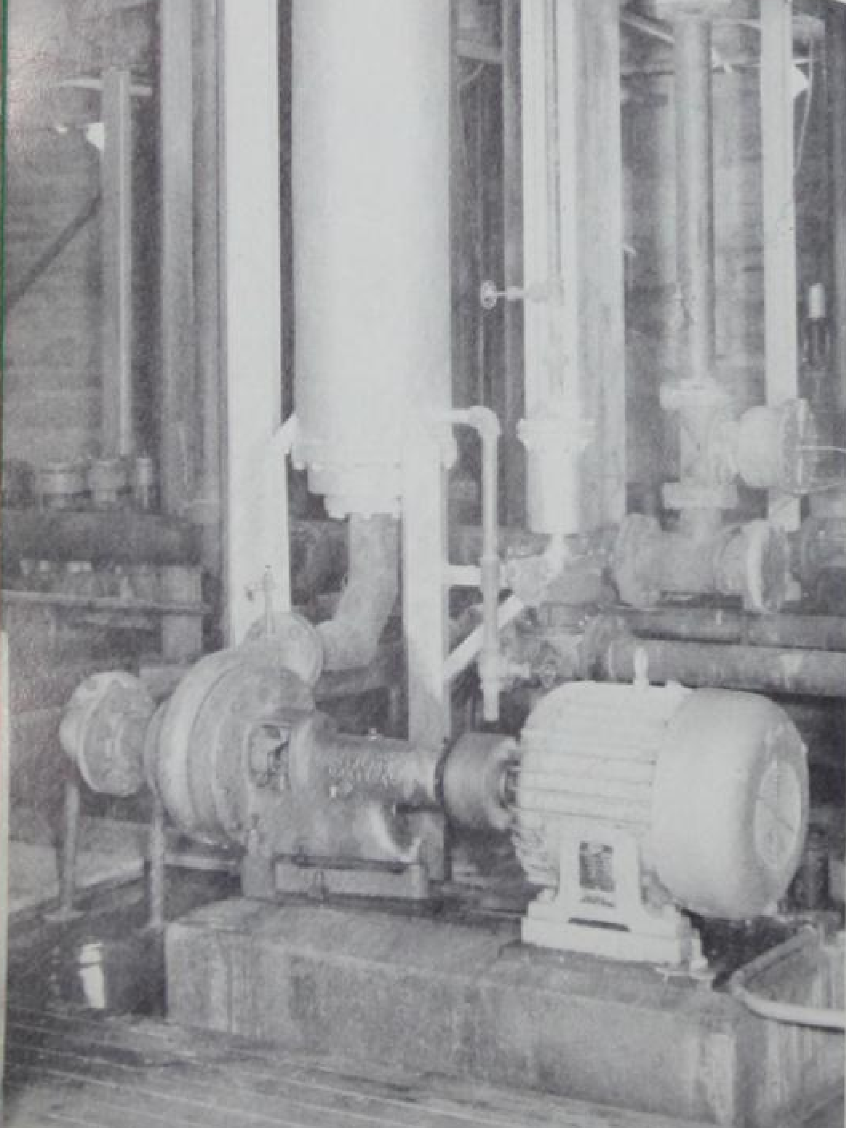




1

1 Water Supply Pump
Cement Mixing Plant
McCurdy Supply Co. Ltd., Winnipeg, Man.

5 Bleach Liquor Pumps
Kier Circulating Service
Johnson & Johnson Co. Ltd., Montreal, Que.



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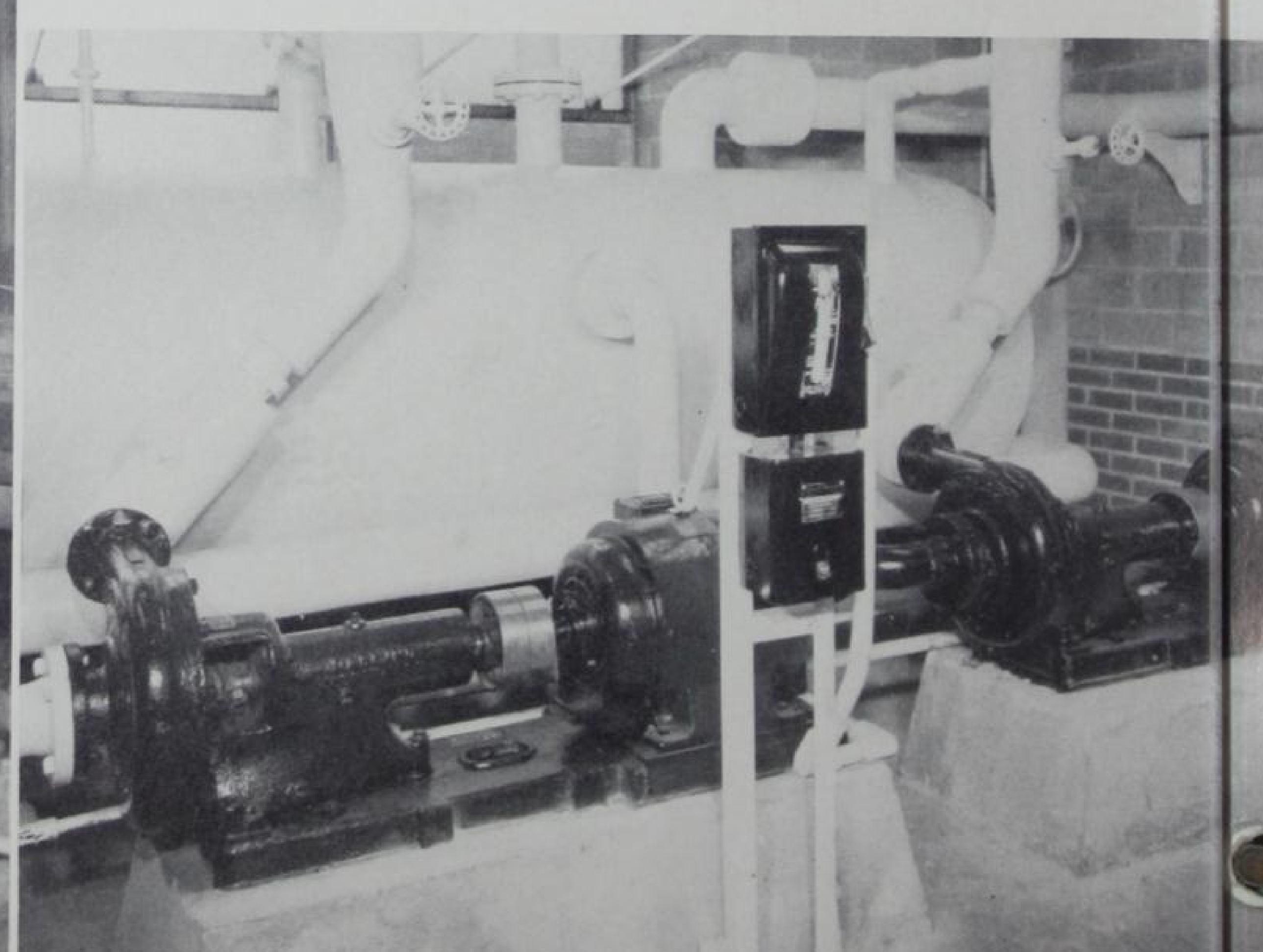
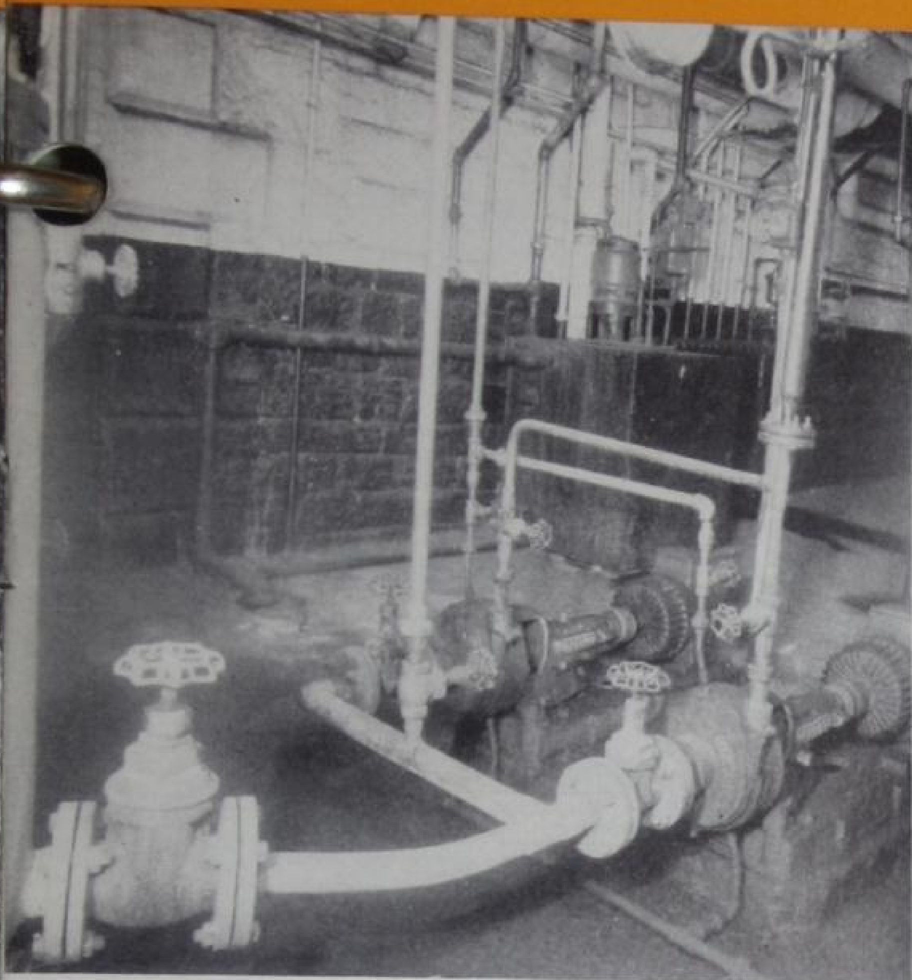
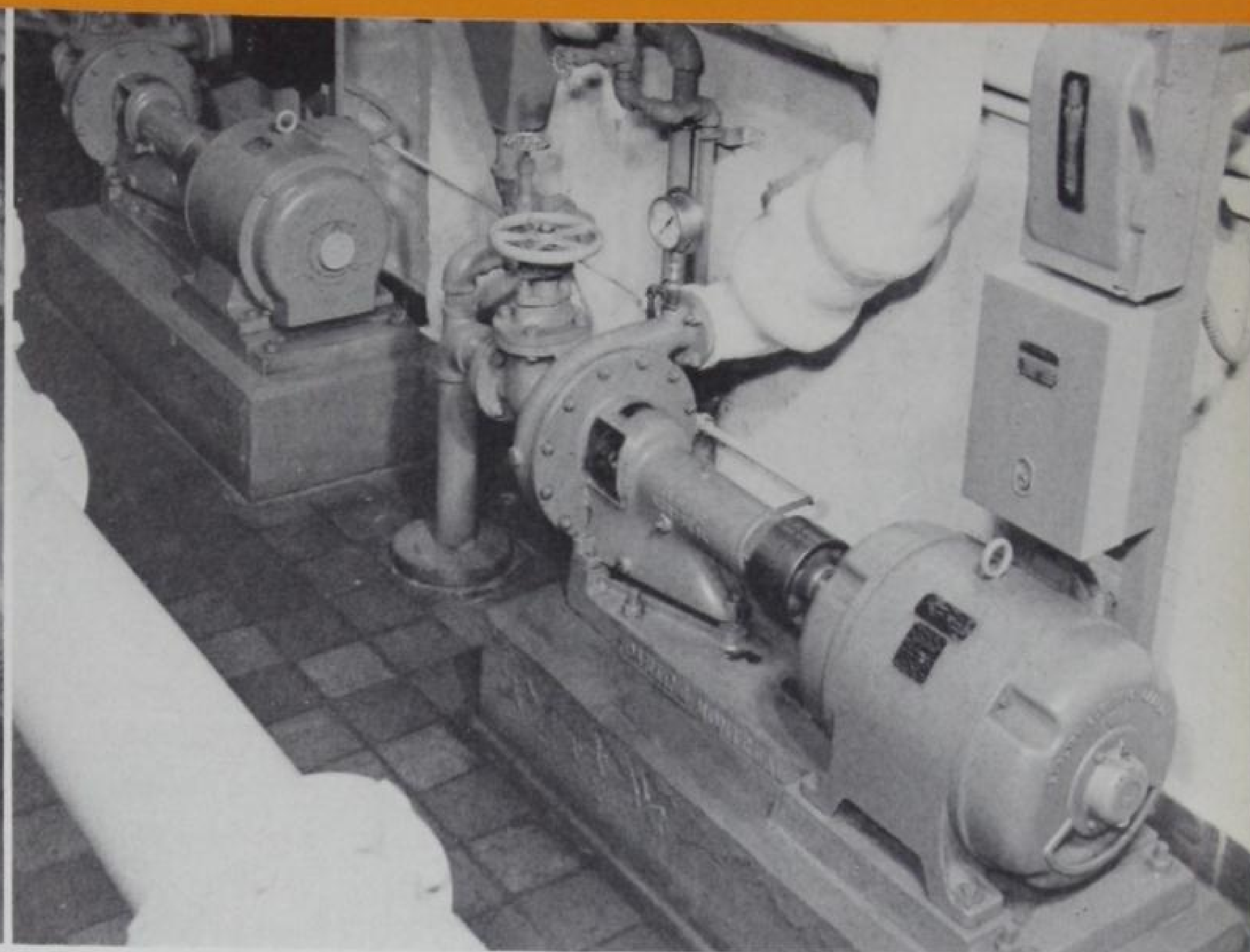






2 3 4

2 Process Pumps
Canada & Dominion Sugar Co. Distillery
Montreal, Que.

3 Still Pumps
Canada & Dominion Sugar Co. Distillery
Montreal, Que.

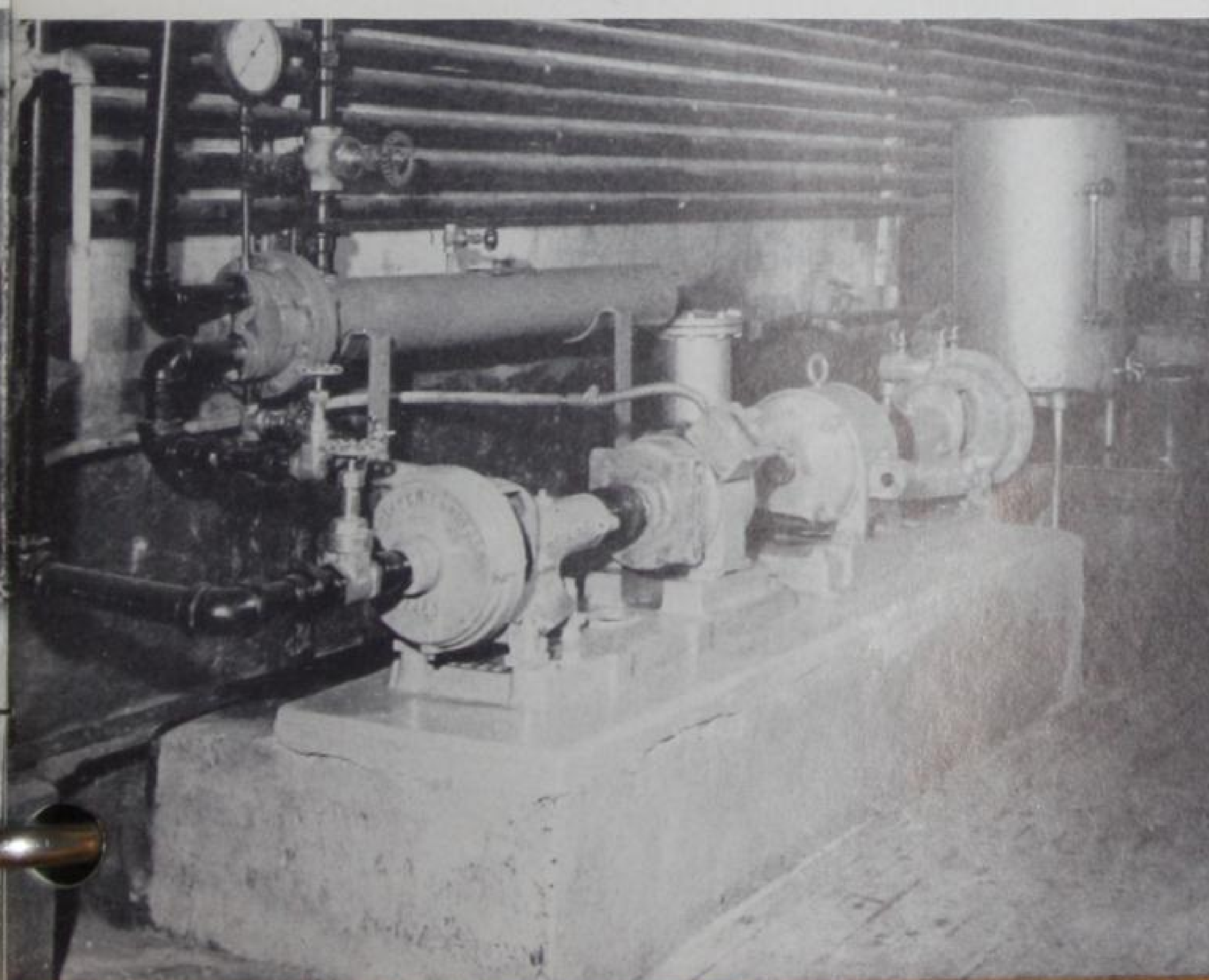
4 Cold Water Supply Pumps on Boiler Feed Service
Northern Electric Co's. New Wire & Cable Plant
Ville St. Pierre, Que.

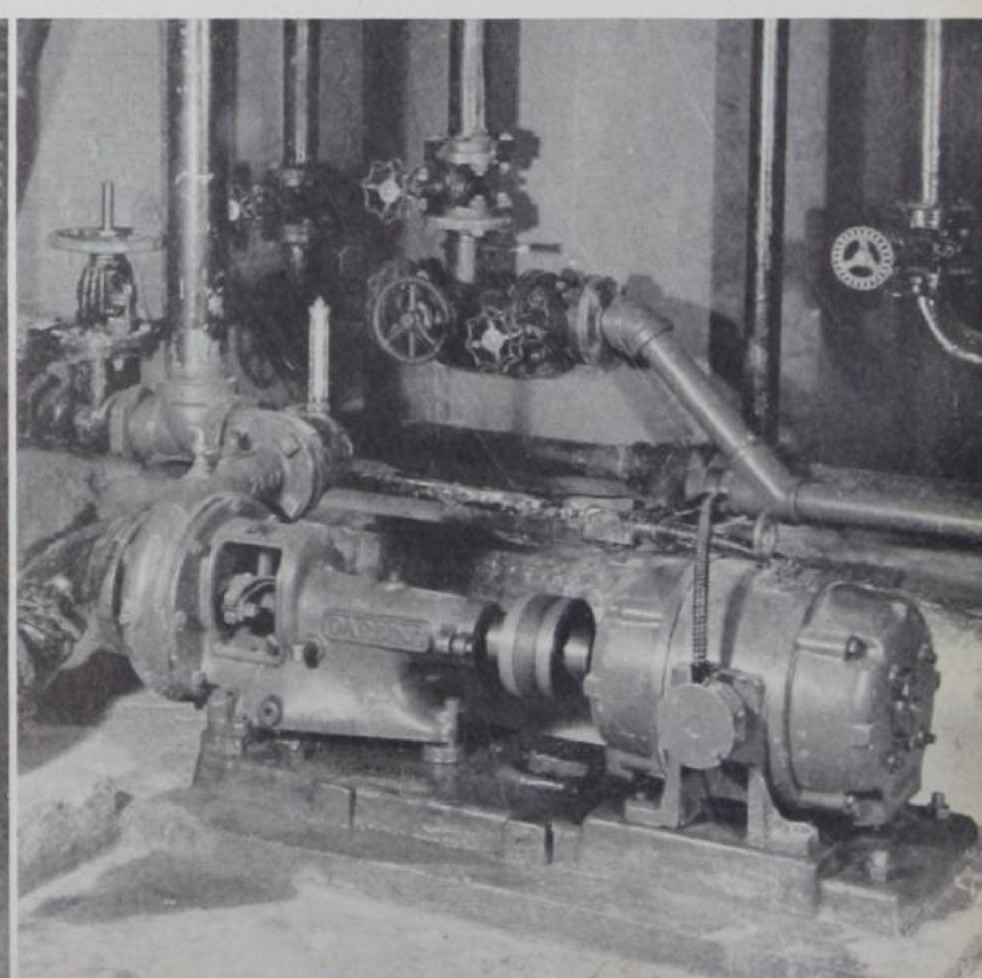
6 Condensate Pumps
Northern Electric Co., Wire & Cable
Plant, Ville St. Pierre, Que.

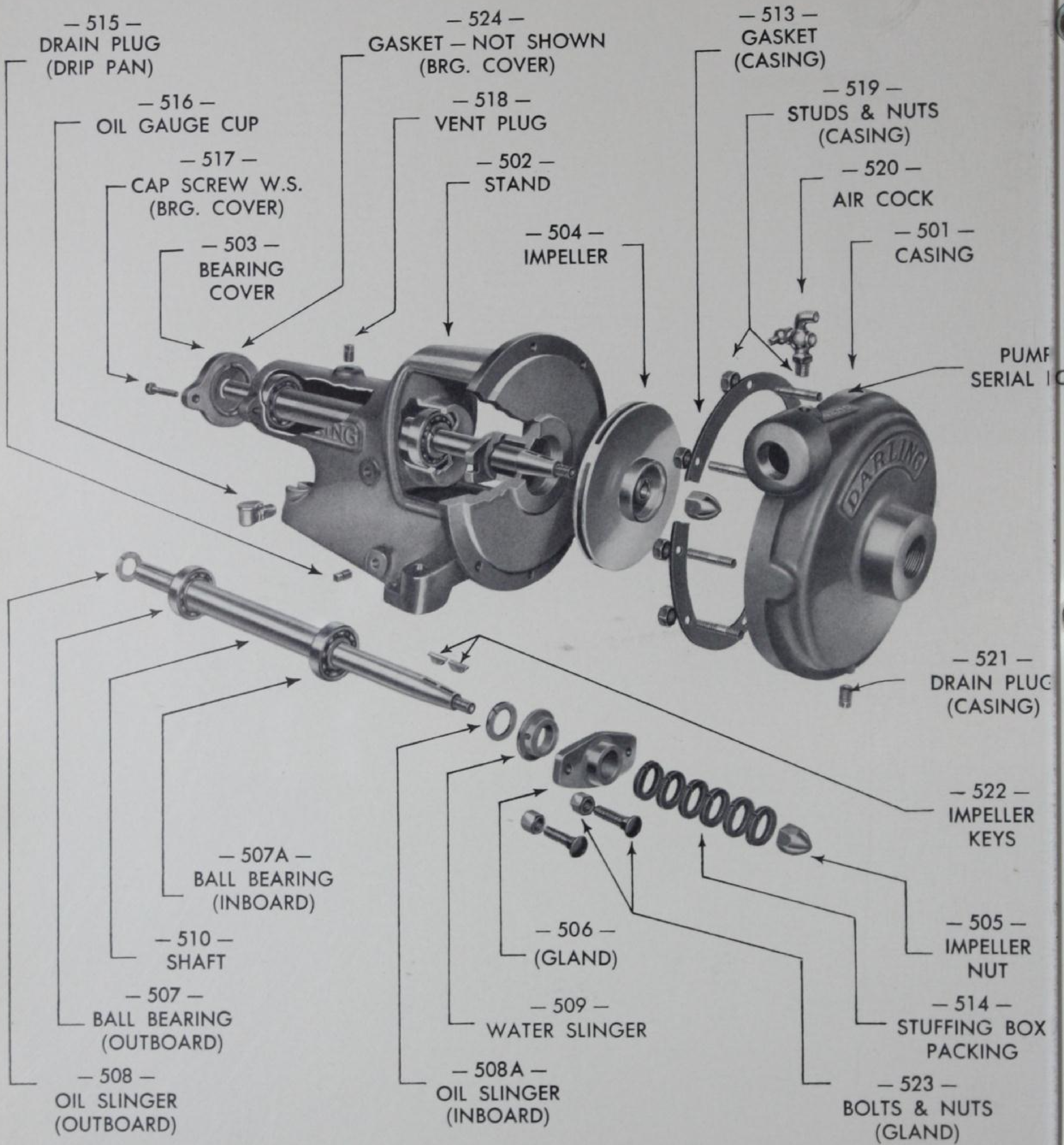
7 Boiler Feed Pump & Brine Heater Pumps
Canada Cold Storage Co., Ltd.,
Montreal, Que.

8 Circulating Pump
Y.M.H.A. Swimming Pool
Montreal, Que.

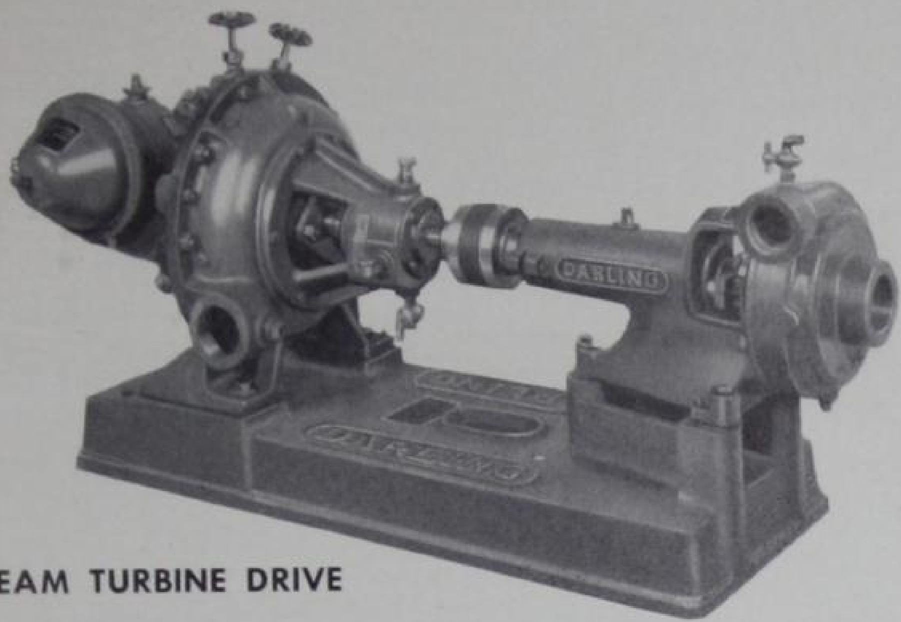
6 7 8



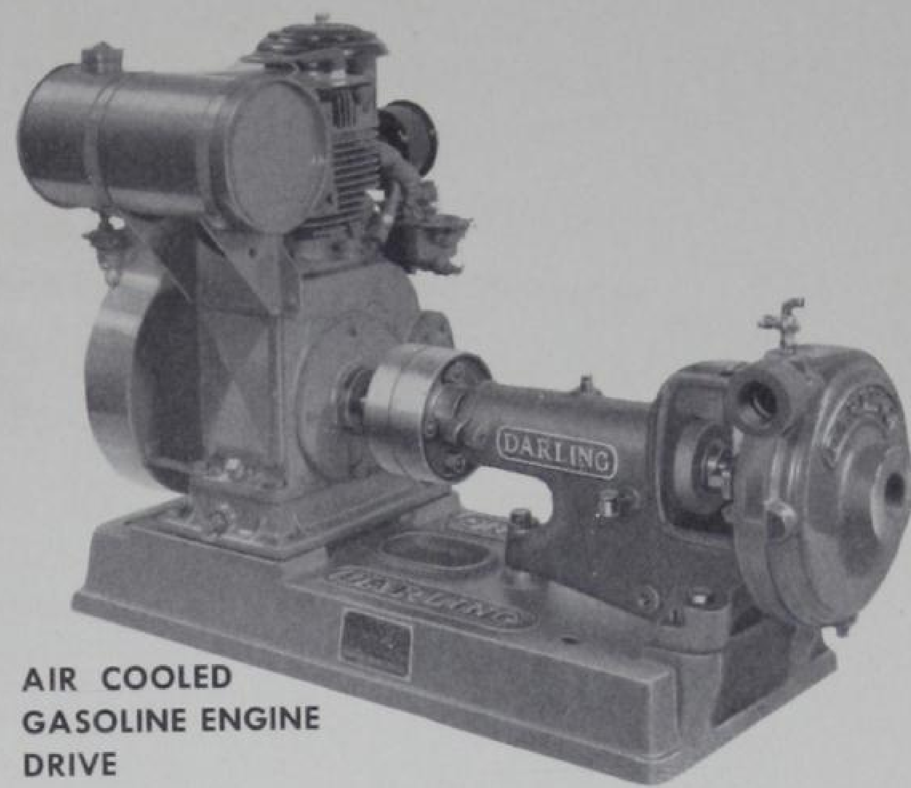




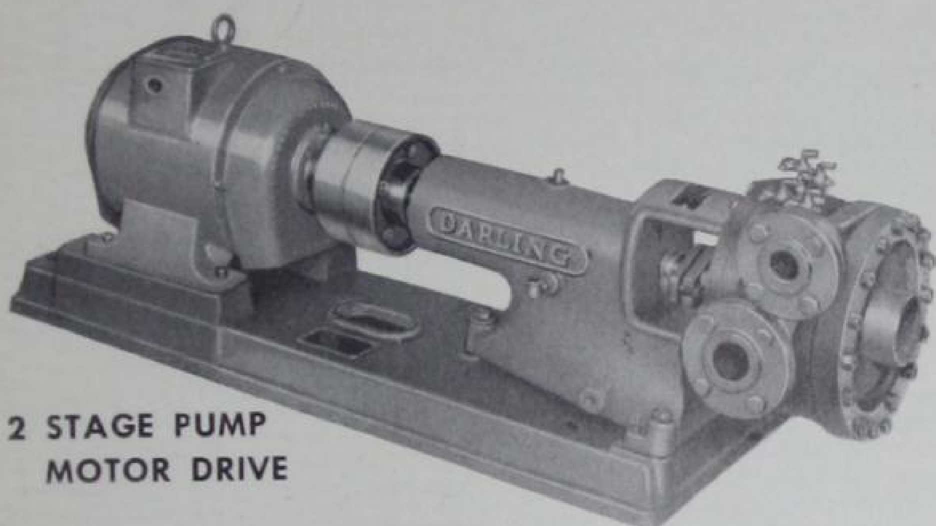
Darling Class "D" Centrifugal Pump



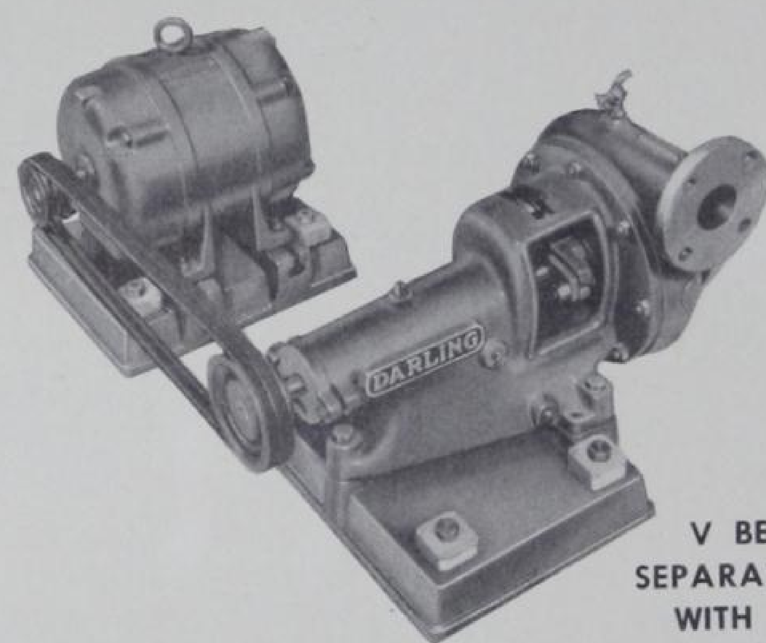
STEAM TURBINE DRIVE



AIR COOLED
GASOLINE ENGINE
DRIVE

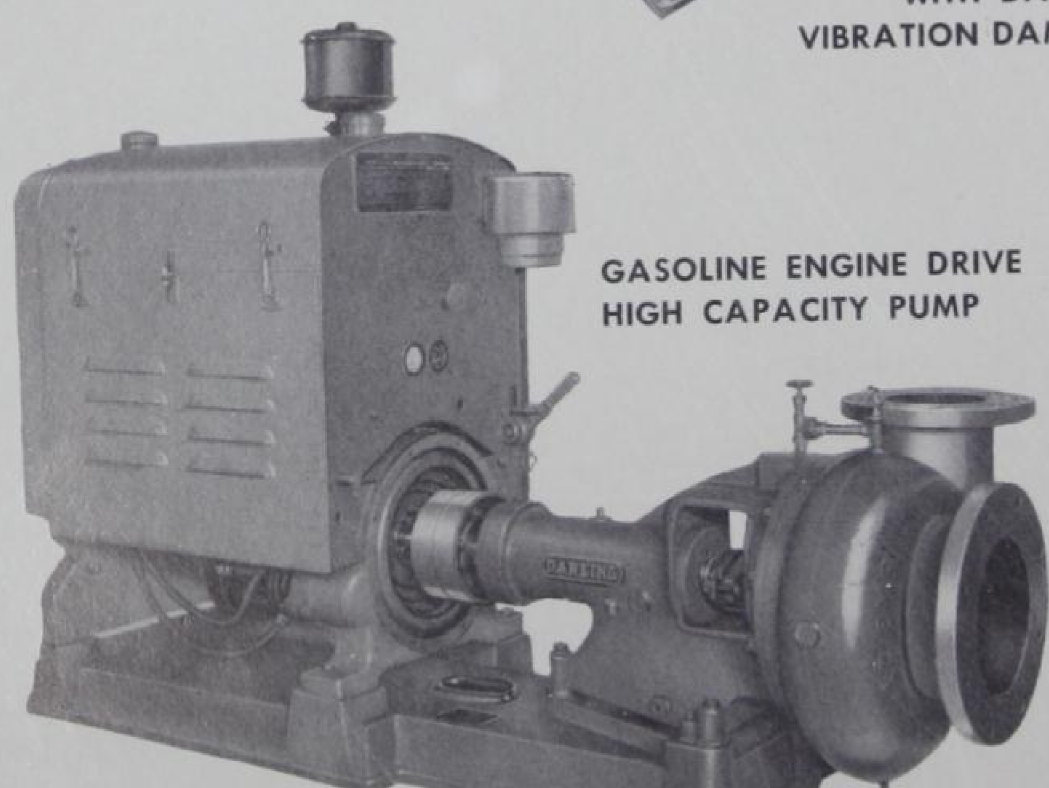


2 STAGE PUMP
MOTOR DRIVE



V BELT DRIVE
SEPARATE BASES
WITH DARLING
VIBRATION DAMPERS

VERTICAL MARINE TYPE
MOTOR DRIVE



GASOLINE ENGINE DRIVE
HIGH CAPACITY PUMP

Impeller is of the efficient closed design taper bored for easy removal from shaft.

Hydraulically balanced Impeller reduces load on bearings and pressure on packing.

Pump parts positively located in position by spigots and shoulders.

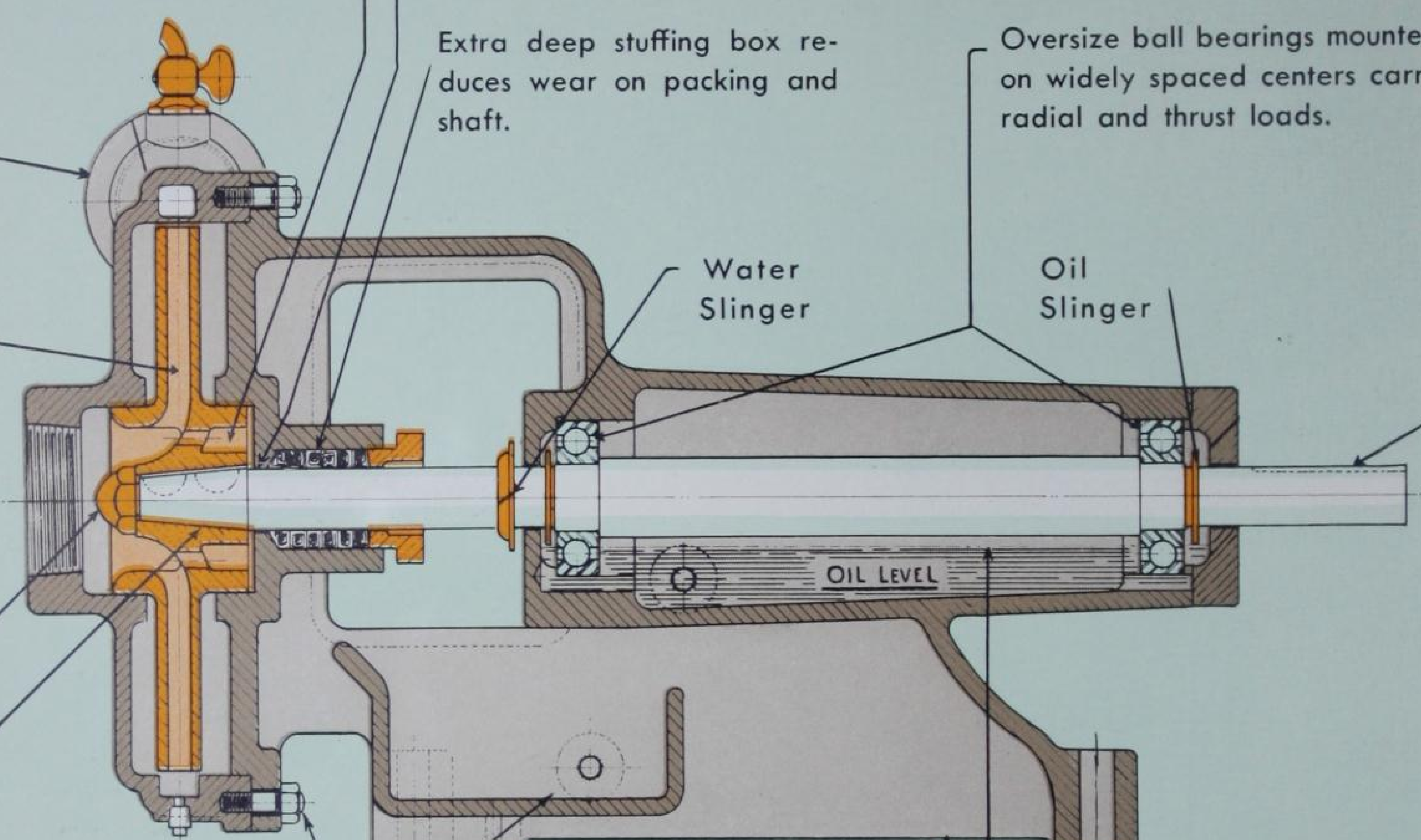
Pump Casing with Top Horizontal Discharge prevents vapour binding.

Casing Bearing eliminated, removing weakness of end suction pumps.

Large diameter shaft insures smooth operation and reduced wear.

Extra deep stuffing box reduces wear on packing and shaft.

Oversize ball bearings mounted on widely spaced centers carry radial and thrust loads.



Tapered end of Shaft gives maximum strength and durability.

Pan to Catch Drips from Gland.

Ball bearings running in oil bath require minimum attention.

Impeller driven by key and secured in position on shaft by capnut.

Casing Secured to Frame by Studs and Nuts.

Base with three point mounting prevents distortion of frame.

TYPICAL SECTION OF STANDARD CLASS D PUMP

GENERAL DESCRIPTION CLASS "D" PUMP

CASING: Close Grained Cast Iron, hydrostatically tested, and studded for connection to frame.

FRAME: Cast Iron, rigid box type with three point base mounting to prevent distortion.

PACKING: Six rings of the best quality graphite lubricated asbestos packing.

STUFFING BOX: Extra deep, cast integral with frame.

GLAND: Cast Bronze, bolted type with ample room for repacking.

MECHANICAL SEALS: Mechanical Shaft seals can be supplied as an alternative.

IMPELLER: Bronzed closed type with tapered bore and keyway. Balancing hub and holes to keep impeller in hydraulic balance. Water passages file-finished.

SHAFT: Polished Steel, extra large diameter to prevent vibration, tapered to mount impeller.

SHAFT NUT: Bronze, cap type to protect shaft threads. (Shouldered to take end thrust).

BEARINGS: Deep Groove Ball type running in oil bath.

COUPLING: Cast Iron, Pin and Rubber Bush type.

KEYS: Fitted, without setscrews.

GASKETS: Hydrol.

STANDARD BALL BEARING PUMP TYPICAL ENGINEERS SPECIFICATION FOR DIRECT CONNECTED UNITS

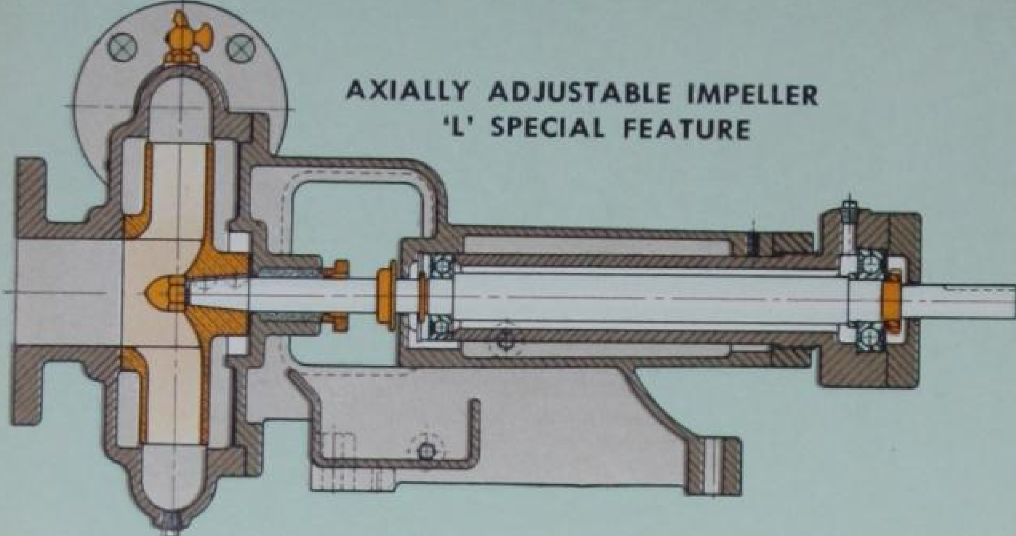
Furnish and install where indicated on plans ...... Class D ...... DARLING Horizontal End Suction Ball Bearing Centrifugal Pump having a capacity of ...... (Imperial) ...... (U.S.) gallons per minute against a total head of ...... feet from all causes including Maximum Suction Lift of ...... feet.

Pump to be driven through a cast iron coupling of the Pin and Rubber Bush type by a ...... H.P., ... Phase, ... Cycle, ... Volt, ... Rev., 40° rise motor.

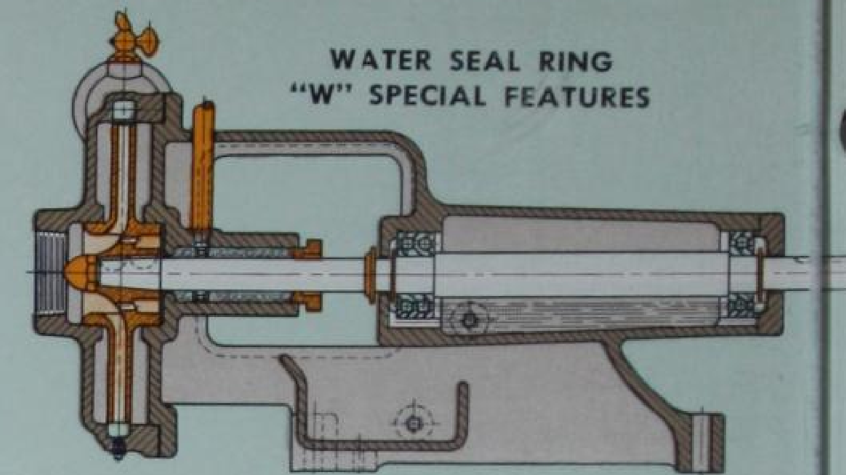
The pump is to be equipped with a bronze enclosed impeller secured by a bronze cap nut on overhung end of threaded, keyed and tapered shaft which runs in two oil lubricated deep groove ball bearings so arranged that the liquid being pumped does not come in contact with the bearings. All parts of the pump to be positively located in position by spigots and shoulders. Pump and motor to be mounted on cast iron baseplate.

STANDARD BALL BEARING PUMP TYPICAL ENGINEERS SPECIFICATION FOR V BELTED UNITS

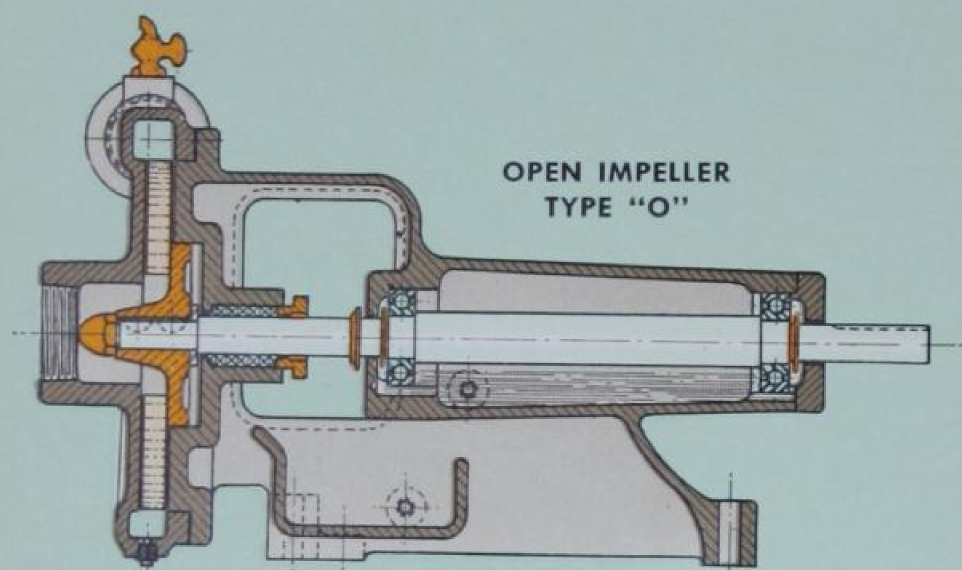
Furnish and install where indicated on plans ...... Class D ...... DARLING Horizontal End Suction Ball Bearing Centrifugal Pump having a capacity of ...... (Imperial) ...... (U.S.) gallons per minute against a total head of ...... feet from all causes including a Maximum Suction Lift of ...... feet. To prevent noise from unit being carried through building, the pump and motor are to be mounted on heavy separate cast iron bases equipped with DARLING Vibration Dampers. The pump is to be run at ...... Revs. being driven through a multi "V" Belt Drive by a ...... H.P. ...... Phase, ... Cyle, ... Volt, ... Revs. ...... Motor The pump is to be equipped with a bronze enclosed impeller secured by a bronze cap nut on overhung end of threaded, keyed and tapered shaft which runs in two oil lubricated deep groove ball bearings so arranged that the liquid being pumped does not come in contact with the bearings. All parts of the pump to be positively located in position by spigots and shoulders.



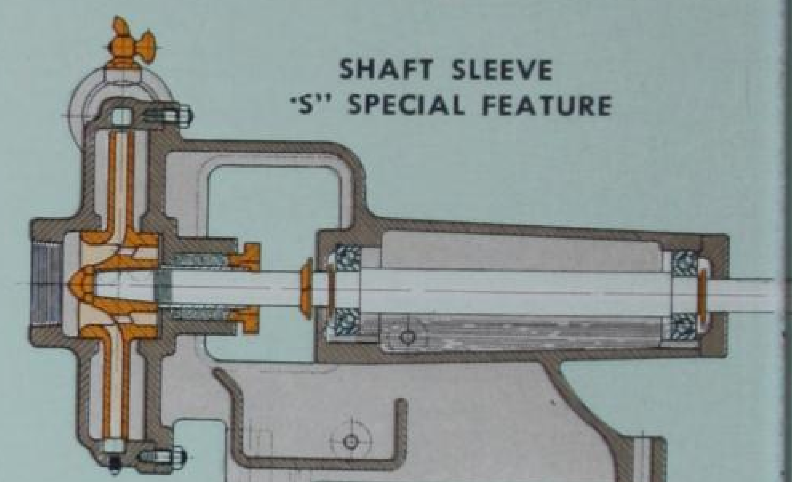
AXIALLY ADJUSTABLE IMPELLER
'L' SPECIAL FEATURE



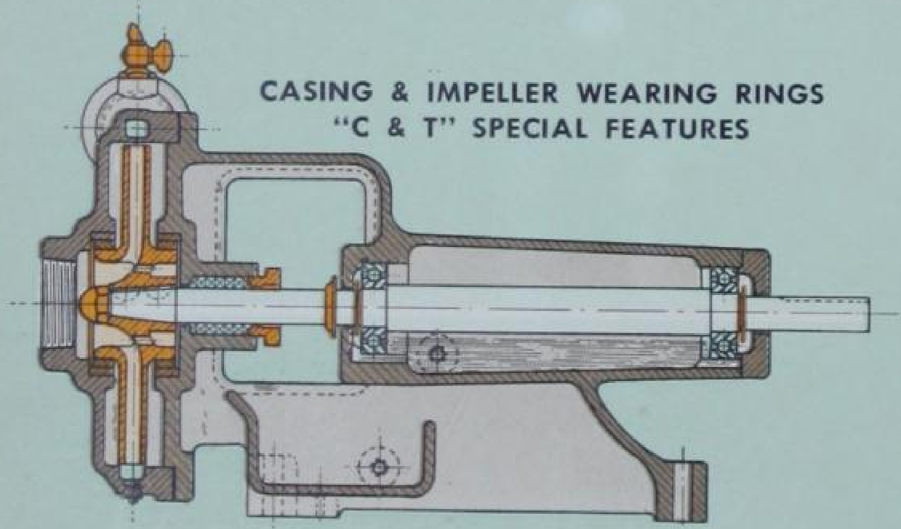
WATER SEAL RING
"W" SPECIAL FEATURES



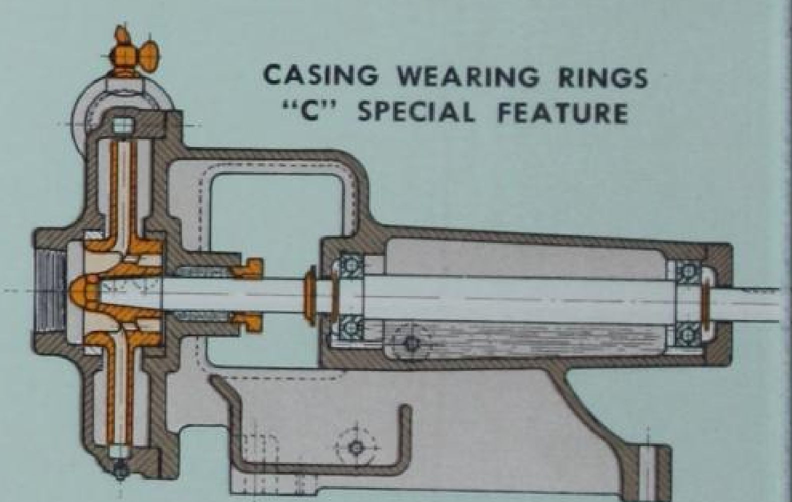
OPEN IMPELLER
TYPE "O"



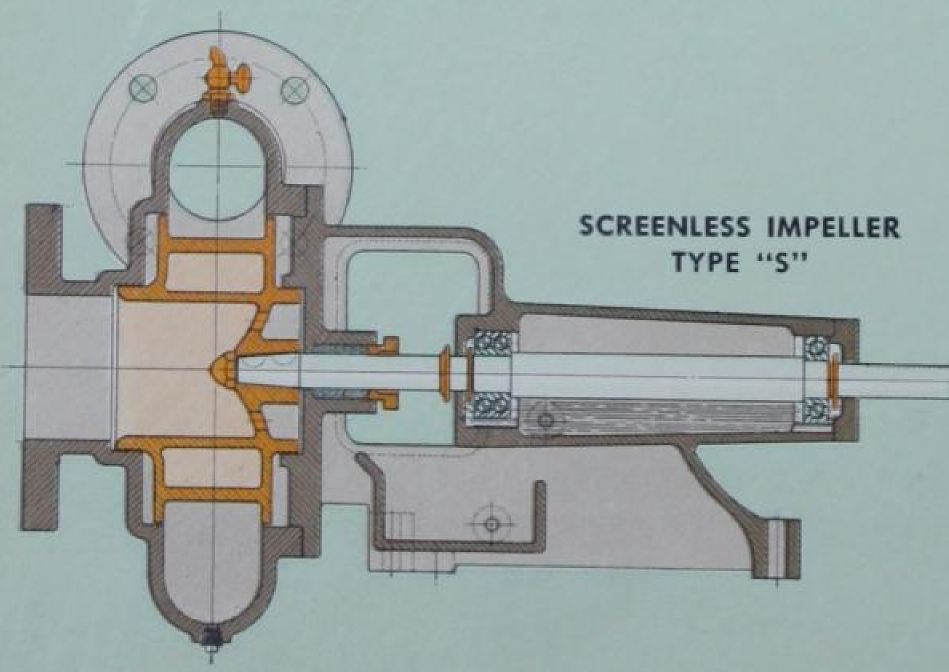
SHAFT SLEEVE
"S" SPECIAL FEATURE



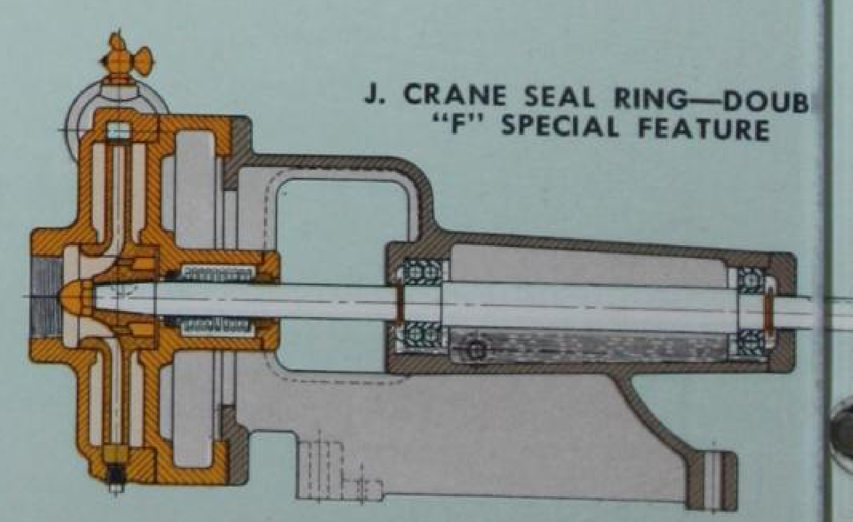
CASING & IMPELLER WEARING RINGS
"C & T" SPECIAL FEATURES



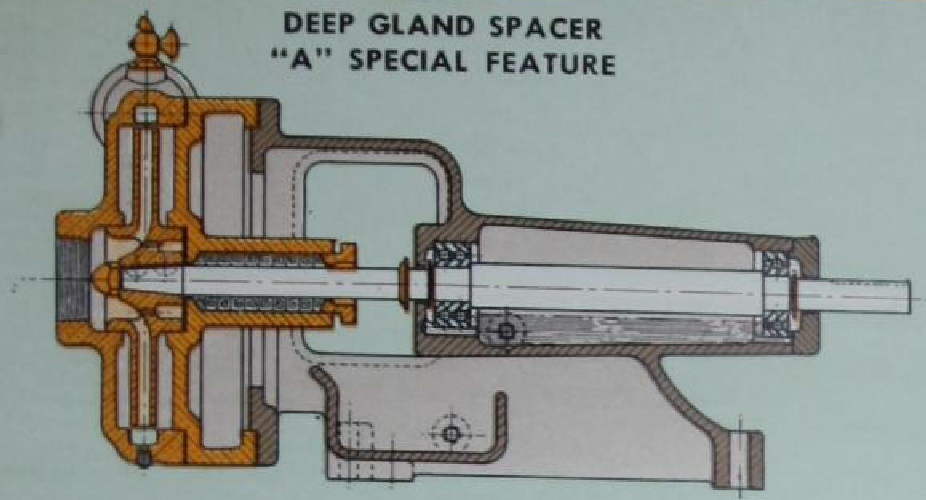
CASING WEARING RINGS
"C" SPECIAL FEATURE



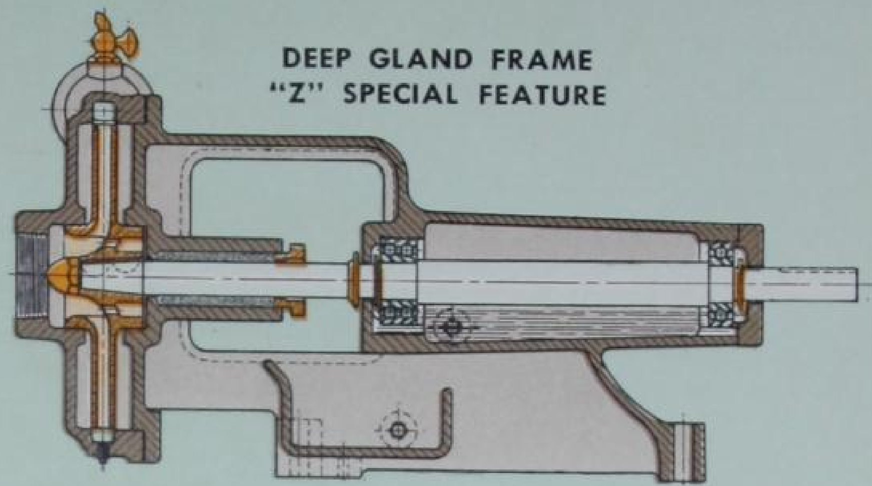
SCREENLESS IMPELLER
TYPE "S"



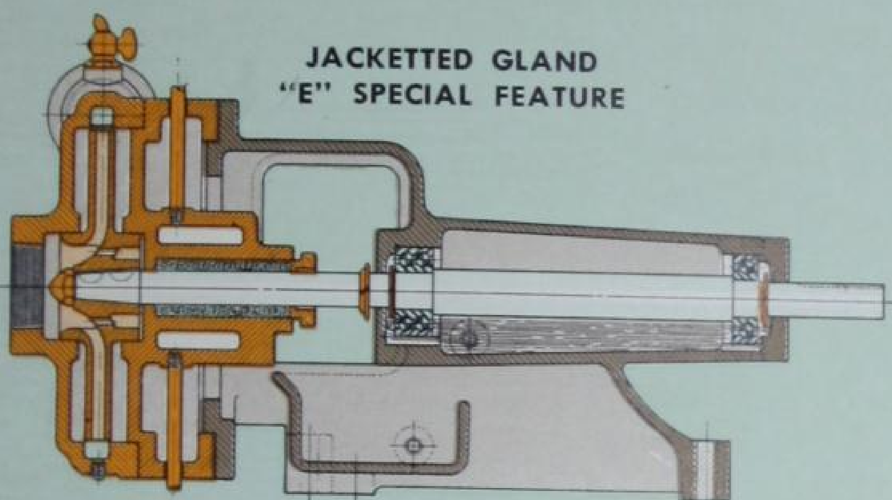
J. CRANE SEAL RING—DOUB
"F" SPECIAL FEATURE



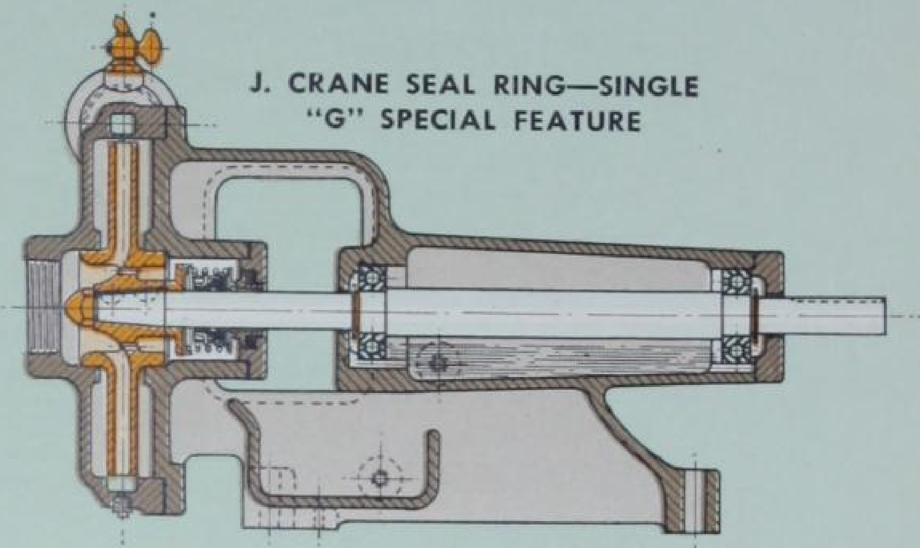
DEEP GLAND SPACER
"A" SPECIAL FEATURE



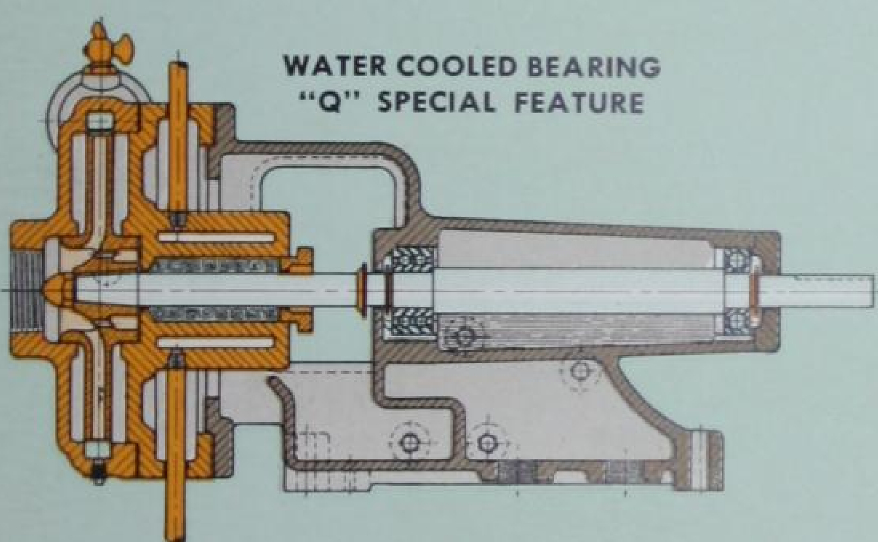
DEEP GLAND FRAME
"Z" SPECIAL FEATURE



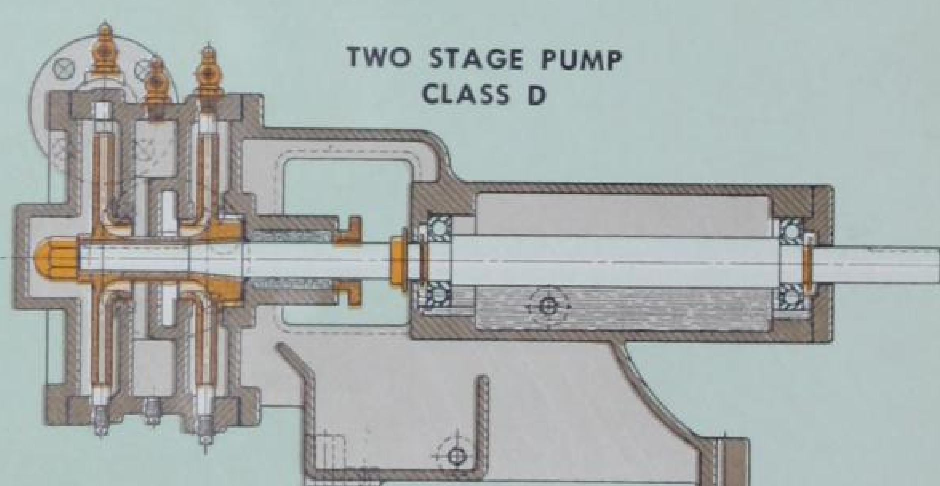
JACKETTED GLAND
"E" SPECIAL FEATURE



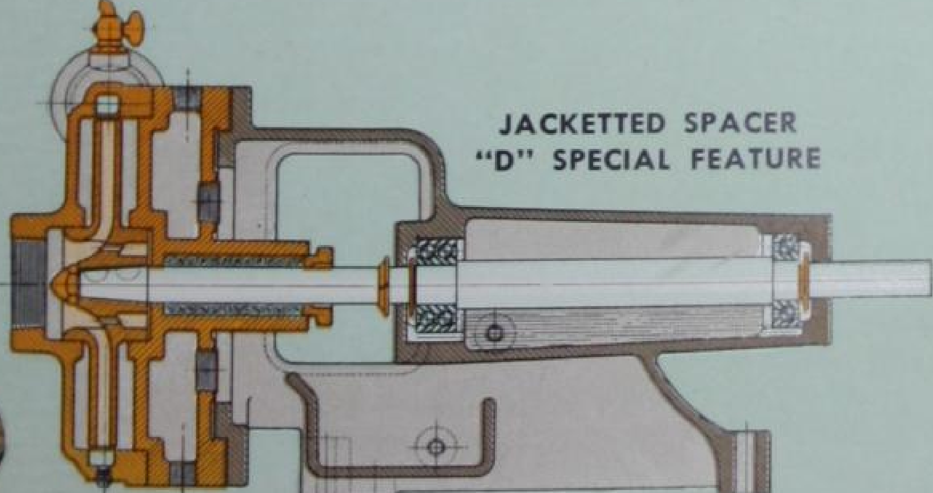
J. CRANE SEAL RING—SINGLE
"G" SPECIAL FEATURE



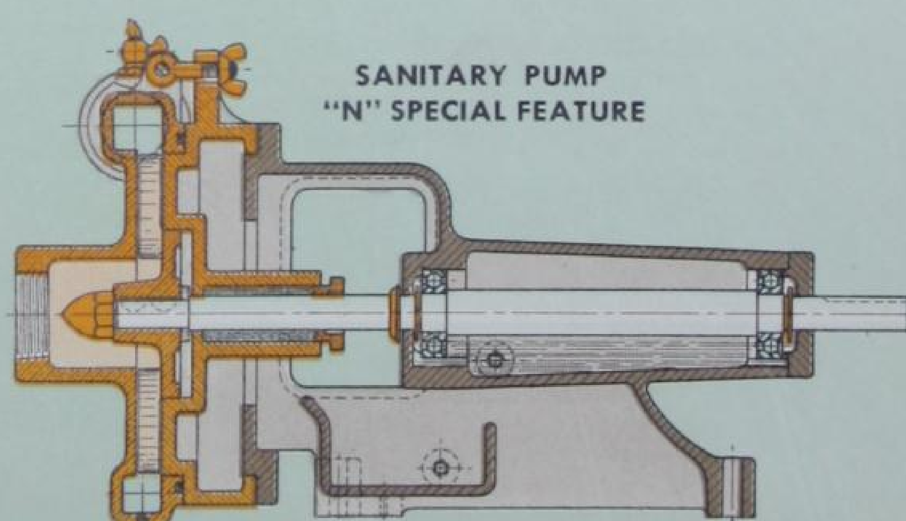
WATER COOLED BEARING
"Q" SPECIAL FEATURE



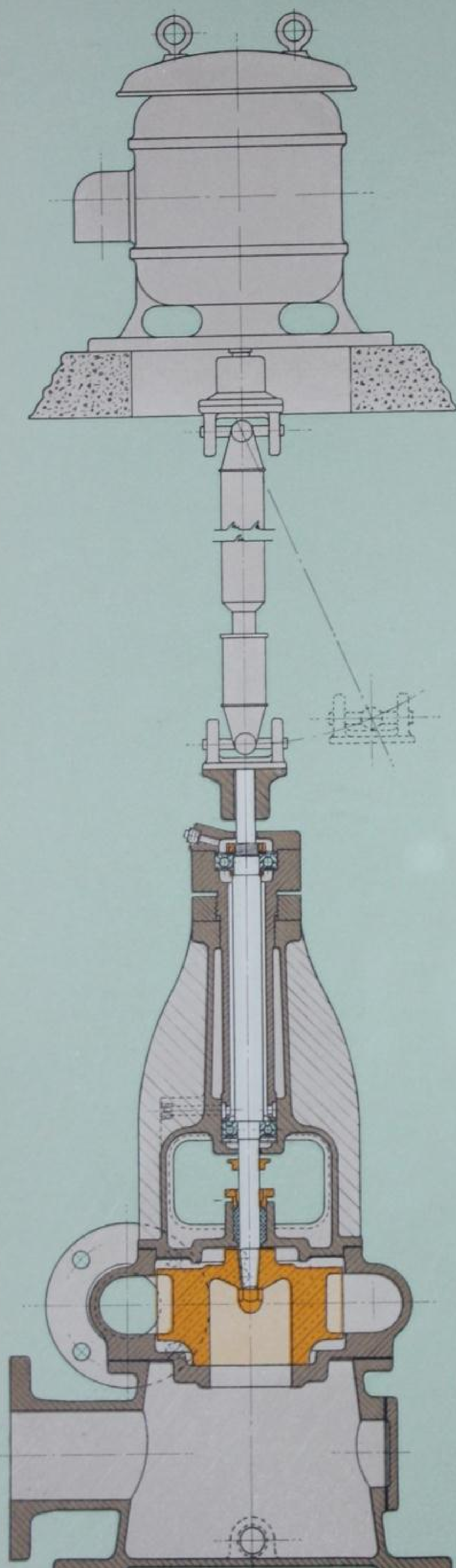
TWO STAGE PUMP
CLASS D



JACKETTED SPACER
"D" SPECIAL FEATURE



SANITARY PUMP
"N" SPECIAL FEATURE

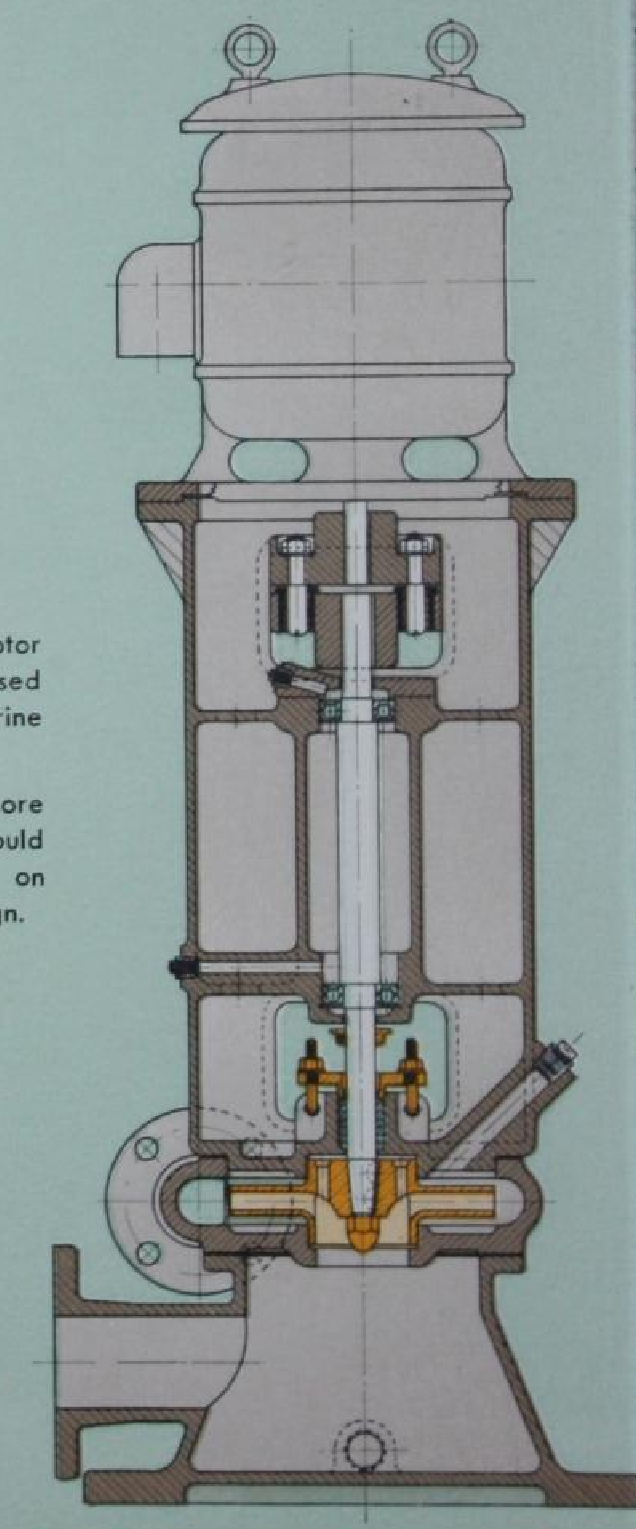


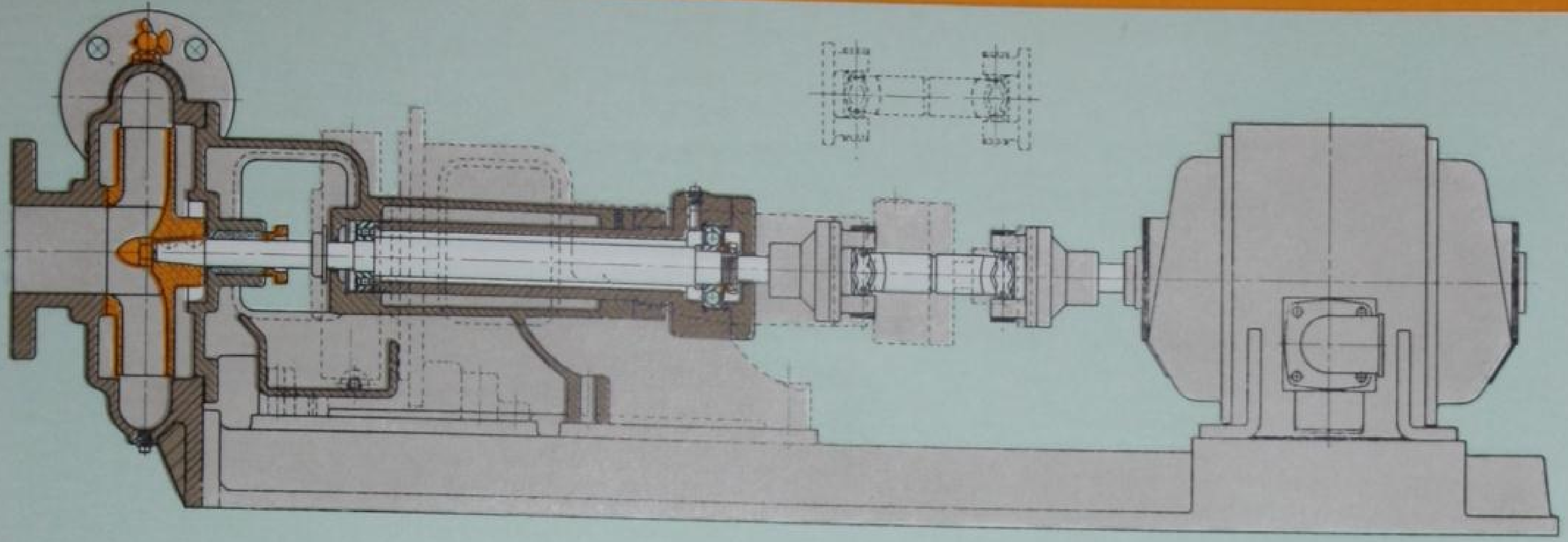
SPECIAL CLASS "D" PUMPS

DARLING Class D Vertical Dry Pit pumps with LU features can be supplied with flexible shaft drive for "Sewage" or "Pressure" service. Additional features shown on Pages 9 and 10 can be incorporated. The use of a flexible shaft decreases installation costs, and also eliminates troubles due to misalignment. By the use of intermediate shafts and bearings, deep pit installations are practicable. The revolving element of the pump can be easily removed for inspection.

DARLING Class D Vertical Direct Connected Motor Driven Pumps with VU Special Features can be used in restricted spaces such as are met with in Marine work.

The Base Casting can be made with one or more suction connections, which in some installations, would eliminate manifolds. Other features illustrated on Pages 9 and 10 can be incorporated in this design.

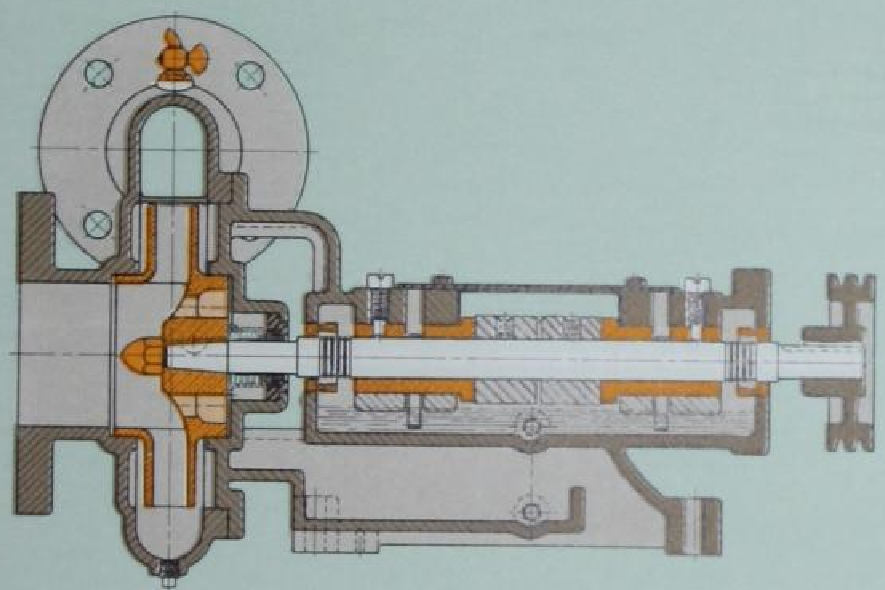




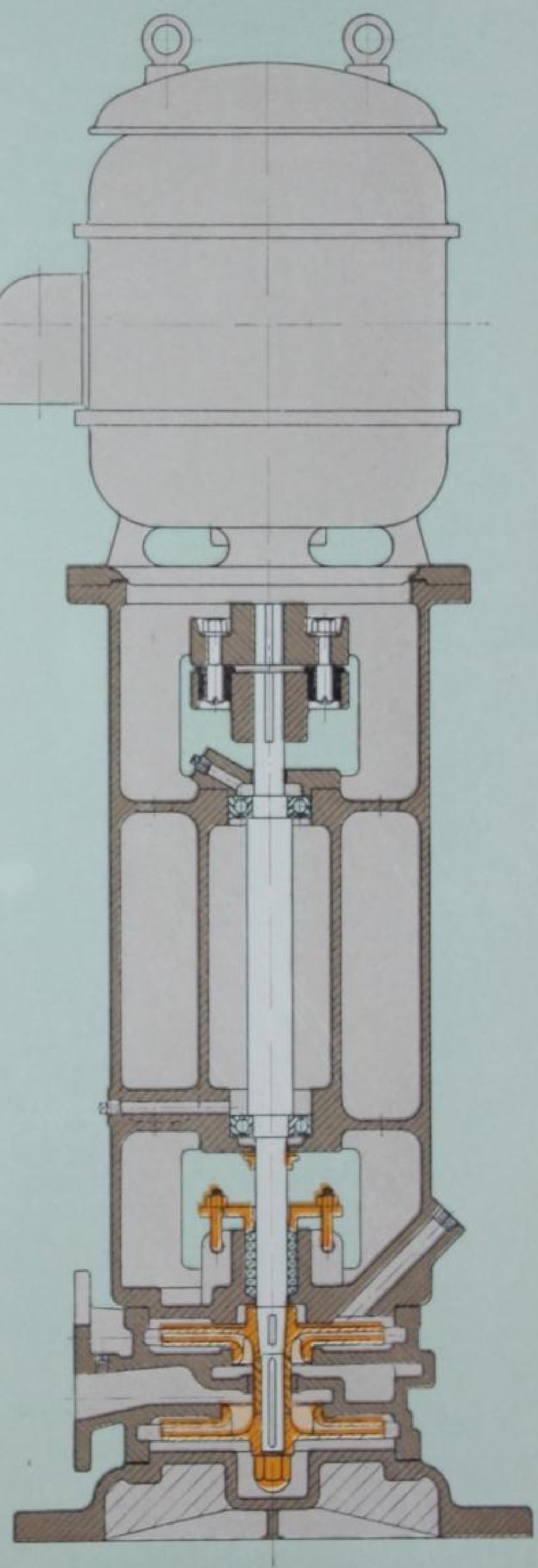
For handling fibrous stock we have developed a special Class D Pump with "L" Special Feature in which the pump impeller is adjustable axially to permit setting impeller clearance to suit.

The thrust bearing is made with a small axial clearance to permit impeller to back off against hydraulic thrust should any fibres get between impeller and casing.

By removing flexible shaft and unbolting frame from base and casing, the whole rotating element can be removed from casing without disturbing pipe connections. As the hydraulic balancing device has been eliminated, an oversize thrust bearing is used.



For use in locations where extreme quietness of operation is desired we have developed the Class D Pump with sleeve bearings and Mechanical Shaft Seal. This pump is designed to be used with a "V" Belt drive as specified on Page 8.



Darling Class D 2-Stage Centrifugal Pumps are designed to work against pressures up to 200 pounds per square inch.

With VU Features as illustrated they occupy small floor area, and are suitable for use where space is restricted, as in Marine practice.

HEAD IN FEET

U.S. GALLONS PER MINUTE	SPEED R.P.M.	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110
10	1150 1450 1750 3500	¾ DWWC ½ ¾ DWWC ½	¾ DWWC ½ ¾ DWWC ½ ¾ DWWC ½	¾ DAAC ½ ¾ DAAC ½ ¾ DWWC ½	¾ DAAC ½ ¾ DAAC ½ ¾ DWWC ½	¾ DAAC ½ ¾ DAAC ½ ¾ DWWC ½	¾ DACC ½ ¾ DAAC ½ ¾ DWWC ½	¾ DACC ¾ ¾ DAAC ½ ¾ DAAC ½	¾ DAYC ¾ ¾ DAAC ½ ¾ DAAC ½	¾ DAYC ¾ ¾ DAAC ½ ¾ DAAC ½	¾ DAYC 1 ¾ DACC ¾ ¾ DAAC ¾	¾ DAYC 1½ ¾ DACC 1 ¾ DAAC 1	¾ DACC 1½ ¾ DACC 1½	¾ DAYC 2 ¾ DACC 2 ¾ DAWC 1½	¾ DAYC 2 ¾ DACC 2 ¾ DAWC 2	¾ DAYC 2 ¾ DAYC 3 ¾ DAWC 2
15	1150 1450 1750 3500	1 DWWC ½ 1 DWWC ½	1¼ DWWC ½ 1 DWWC ½	1 DAAC ½ 1 DWWC ½ 1 DWWC ½	1 DAAC ½ 1 DAAC ½ 1 DWWC ½	1 DAAC ½ 1 DAAC ½ 1 DWWC ½	1 DACC ½ 1 DAAC ½ 1 DWWC ½	1 DACC ½ ¾ DAAC ¾ ¾ DAAC ¾	¾ DAYC ¾ ¾ DAAC ¾ ¾ DAAC ¾	¾ DAYC 1 ¾ DAAC ¾ ¾ DAAC ¾	¾ DAYC 1½ ¾ DACC 1 ¾ DAAC 1	¾ DAYC 1½ ¾ DACC 1½ ¾ DAAC 1	¾ DAYC 2 ¾ DACC 2 ¾ DAWC 1½	¾ DAYC 2 ¾ DACC 2 ¾ DAWC 2	¾ DAYC 2 ¾ DACC 2 ¾ DAWC 2	¾ DAYC 3 ¾ DAWC 3
20	1150 1450 1750 3500	1½ DWWC ½ 1½ DWWC ½	1½ DWWC ½ 1¼ DWWC ½	1 DAAC ½ 1¼ DWWC ½ 1 DWWC ½	1¼ DAAC ½ 1 DAAC ½ 1 DWWC ½	1¼ DAAC ½ 1 DAAC ½ 1 DWWC ½	1 DACC ¾ 1 DAAC ½ 1 DWWC ½	1 DACC 1 1 DAAC ¾ 1 DAAC ½	1 DAYC 1 1 DAAC ¾ 1 DAAC ¾	1 DAYC 1 1 DAAC ¾ 1 DAAC ¾	1 DAYC 1½ 1 DACC 1 1 DAAC 1	1 DAYC 2 1 DACC 1½ 1 DAAC 1½	1 DAYC 2 1 DACC 2 1 DAWC 1	1 DAYC 2 1 DACC 2 1 DAWC 1½	1 DAYC 3 1 DACC 3 1 DAWC 1½	1 DAYC 3 1 DAYC 3 1 DAWC 1½
25	1150 1450 1750 3500	1½ DWWC ½ 1½ DWWC ½	1½ DWWC ½ 1½ DWWC ½ 1¼ DWWC ½	1¼ DAAC ½ 1¼ DWWC ½ 1¼ DWWC ½	1¼ DAAC ½ 1 DAAC ½ 1¼ DWWC ½	1¼ DAAC ½ 1 DAAC ½ 1¼ DWWC ½	1¼ DACC ¾ 1 DAAC ¾ 1¼ DWWC ½	1¼ DACC 1 1¼ DAAC ¾ 1 DAAC ¾	1¼ DAYC 1 1¼ DAAC ¾ 1 DAAC ¾	1¼ DAYC 1½ 1¼ DAAC 1 1 DAAC 1	1¼ DAYC 1½ 1 DACC 1½ 1 DAAC 1½	1¼ DAYC 2 1 DAYC 1½ 1 DACC 1½	1 DAYC 2 1 DACC 2 1 DAWC 1½	1 DAYC 2 1 DACC 3 1 DAWC 1½	1 DAYC 3 1 DACC 3 1 DAWC 1½	1 DAYC 3 1 DAYC 3 1 DAWC 2
30	1150 1450 1750 3500	1½ DWWC ½ 1½ DWWC ½	1½ DWWC ½ 1½ DWWC ½ 1¼ DWWC ½	1½ DAAC ½ 1½ DWWC ½ 1¼ DWWC ½	1½ DAAC ½ 1¼ DAAC ½ 1¼ DWWC ½	1½ DAAC ¾ 1¼ DAAC ½ 1¼ DWWC ½	1¼ DACC 1 1¼ DAAC ¾ 1¼ DAAC ¾	1¼ DACC 1 1¼ DAAC ¾ 1¼ DAAC 1	1¼ DAYC 1½ 1¼ DAAC ¾ 1¼ DAAC 1	1¼ DAYC 1½ 1¼ DAAC 1 1¼ DAAC 1	1¼ DAYC 1½ 1 DACC 1½ 1¼ DAAC 1½	1¼ DAYC 2 1 DAYC 2 1¼ DACC 1½ 1 DAWC 1½	1 DAYC 2 1¼ DACC 2 1 DAWC 1½	1 DAYC 3 1¼ DACC 3 1 DAWC 1½	1 DAYC 3 1 DAYC 3 1 DAWC 2	1 DAYC 3 1 DAYC 3 1 DAWC 2
35	1150 1450 1750 3500	1½ DWWC ½ 1½ DWWC ½ 1¼ DWWC ½	1½ DWWC ½ 1½ DWWC ½ 1¼ DWWC ½	1½ DAAC ½ 1½ DWWC ½ 1¼ DWWC ¾	1½ DAAC ¾ 1¼ DAAC ¾ 1¼ DWWC ¾	1½ DAAC ¾ 1¼ DAAC ¾ 1¼ DWWC ¾	1½ DACC 1 1¼ DAAC ¾ 1¼ DAAC ¾	1½ DACC 1 1¼ DAAC ¾ 1¼ DAAC 1	1¼ DAYC 1½ 1¼ DAAC 1 1¼ DAAC 1	1¼ DAYC 1½ 1½ DAAC 1½ 1¼ DAAC 1	1¼ DAYC 2 1¼ DACC 1½ 1¼ DAAC 1½	1½ DAYC 2 1¼ DAYC 2 1¼ DACC 1½ 1 DAWC 1½	1¼ DAYC 3 1¼ DACC 2 1 DAWC 1½	1¼ DAYC 3 1¼ DACC 3 1 DAWC 2	1¼ DAYC 3 1 DAYC 3 1 DAWC 2	1¼ DAYC 5 1 DAYC 3 1 DAWC 2
40	1150 1450 1750 3500	2 DWWC ½ 1½ DWWC ½	2 DWWC ½ 1½ DWWC ½ 1½ DWWC ½	1½ DAAC ½ 1½ DWWC ½ 1½ DWWC ½	1½ DAAC ¾ 1½ DAAC ¾ 1½ DWWC ¾	1½ DAAC ¾ 1½ DAAC ¾ 1½ DWWC ¾	1½ DACC 1 1½ DAAC ¾ 1½ DAAC ¾	1½ DACC 1½ 1½ DAAC 1 1¼ DAAC 1	1½ DAYC 1½ 1½ DAAC 1 1¼ DAAC 1	1½ DAYC 1½ 1½ DAAC 1½ 1¼ DAAC 1½	1½ DAYC 2 1¼ DACC 2 1¼ DAAC 1½	1½ DAYC 3 1¼ DAYC 2 1¼ DACC 1½ 1 DAWC 1½	1¼ DAYC 3 1¼ DACC 3 1 DAWC 2	1¼ DAYC 3 1¼ DACC 3 1 DAWC 2	1¼ DAYC 3 1 DAYC 3 1 DAWC 2	1¼ DAYC 5 1 DAYC 5 1 DAWC 3
50	1150 1450 1750 3500	2 DWWC ½	2 DWWC ½ 2 DWWC ½ 1½ DWWC ½	1½ DAAC ½ 2 DWWC ¾ 1½ DWWC ¾	1½ DAAC ¾ 1½ DAAC ¾ 1½ DAAC ¾	1½ DAAC 1 1½ DAAC ¾ 1½ DAAC ¾	1½ DACC 1 1½ DAAC 1 1½ DAAC ¾	1½ DACC 1½ 1½ DAAC 1 1½ DAAC 1	1½ DAYC 1½ 1½ DAAC 1½ 1½ DAAC 1½	1½ DAYC 1½ 1½ DAAC 1½ 1½ DAAC 1½	1½ DAYC 2 1½ DACC 2 1½ DAAC 1½	1½ DAYC 3 1½ DAYC 3 1¼ DACC 2 1¼ DAWC 2	1½ DAYC 3 1¼ DACC 3 1¼ DAWC 3	1½ DAYC 3 1¼ DACC 3 1¼ DAWC 3	1½ DAYC 5 1¼ DAYC 5 1¼ DAWC 3	1½ DAYC 5 1¼ DAYC 5 1¼ DAWC 5
60	1150 1450 1750 3500	2 DWWC ½ 1½ DWWC ½ 1½ DWWC ½	2 DWWC ¾ 2 DWWC ½ 1½ DWWC ¾	1½ DAAC ¾ 2 DWWC ¾ 1½ DWWC ¾	1½ DAAC ¾ 1½ DAAC ¾ 1½ DAAC ¾	1½ DAAC 1 1½ DAAC ¾ 1½ DAAC ¾	1½ DACC 1 1½ DAAC 1 1½ DAAC 1	1½ DACC 1½ 1½ DAAC 1½ 1½ DAAC 1	1½ DAYC 1½ 1½ DAAC 1½ 1½ DAAC 1½	1½ DAYC 2 1½ DAAC 1½ 1½ DAAC 1½	1½ DAYC 2 1½ DACC 2 1½ DAAC 2	1½ DAYC 3 1½ DACC 2 1¼ DAWC 3	1½ DAYC 3 1½ DACC 3 1¼ DAWC 3	1½ DAYC 5 1½ DACC 3 1¼ DAWC 3	1½ DAYC 5 1½ DAYC 5 1¼ DAWC 3	1½ DAYC 5 1½ DAYC 5 1¼ DAWC 5
75	1150 1450 1750 3500	2 DWWC ½ 2 DWWC ½ 1½ DWWC ¾	2 DWWC ¾ 2 DWWC ¾ 2 DWWC ¾	1½ DAAC ¾ 2 DWWC ¾ 2 DWWC ¾	1½ DAAC 1 1½ DAAC 1 1½ DAAC 1	1½ DACC 1½ 1½ DAAC 1 1½ DAAC 1	1½ DACC 1½ 1½ DAAC 1½ 1½ DAAC 1½	1½ DAYC 1½ 1½ DAAC 1½ 1½ DAAC 1½	1½ DAYC 2 1½ DAAC 2 1½ DAAC 1½	1½ DAYC 2 1½ DAAC 2 1½ DAAC 2	1½ DAYC 3 1½ DACC 3 1½ DAAC 2	1½ DAYC 3 1½ DAAC 3	1½ DAYC 5 1½ DACC 3 1½ DAWC 3	1½ DAYC 5 1½ DACC 5 1½ DAWC 3	1½ DAYC 5 1½ DAYC 5 1½ DAWC 3	1½ DAYC 5 1½ DAYC 5 1½ DAWC 5
100	1150 1450 1750 3500	2 DWWC ¾ 2 DWWC ¾ 2 DWWC ¾	2 DAAC 1 2 DWWC ¾ 2 DWWC ¾	2 DAAC 1 2 DWWC 1 2 DWWC 1	2 DAAC 1½ 2 DAAC 1½ 2 DAAC 1	2 DAAC 1½ 2 DAAC 1½ 2 DAAC 1½	2 DXCC 2 2 DAAC 2 2 DAAC 2	2 DXCC 2 2 DAAC 2 2 DAAC 2	2 DXCC 2 2 DAAC 2 2 DAAC 2	2 DXYC 3 2 DAAC 3 2 DAAC 2	2 DXYC 3 2 DXCC 3 2 DAAC 3	2 DXYC 3 2 DXCC 3 2 DAAC 3	2 DXYC 5 2 DAAC 5 1½ DAWC 5	2 DXYC 5 1½ DAYC 5 1½ DAWC 5	2 DXYC 7½ 1½ DAYC 7½ 1½ DAWC 5	2 DXYC 7 1½ DAYC 7 1½ DAWC 5
125	1150 1450 1750 3500	2 DAAC 1 2 DWWC ¾ 2 DWWC ¾	2 DAAC 1 2 DWWC 1 2 DWWC 1	2 DAAC 1 2 DAAC 1 2 DWWC 1	2 DAAC 1½ 2 DAAC 1½ 2 DAAC 1½	2 DAAC 1½ 2 DAAC 1½ 2 DAAC 1½	2 DXCC 2 2 DAAC 2 2 DAAC 2	2 DXCC 2 2 DAAC 2 2 DAAC 2	2 DXYC 3 2 DAAC 3 2 DAAC 2	2 DXYC 3 2 DAAC 3 2 DAAC 3	2 DXYC 3 2 DXCC 5 2 DAAC 3	2 DXYC 5 2 DXCC 5 2 DAAC 5	2 DXYC 5 2 DAAC 5 2 DAWC 5	2 DXYC 7½ 2 DXCC 5 2 DAWC 5	2 DXYC 7½ 2 DXCC 7½ 2 DAWC 5	2 DXCC 7 2 DAWC 7
150	1150 1450 1750 3500	3 DAAC 1 3 DAAC ¾ 3 DAAC ¾	3 DAAC 1 3 DAAC 1 3 DAAC 1	3 DAAC 1½ 2 DAAC 1½ 2 DAAC 1½	3 DAAC 2 2 DAAC 2 2 DAAC 2	3 DAAC 2 2 DAAC 2 2 DAAC 2	2 DXYC 3 2 DAAC 3 2 DAAC 2	2 DXYC 3 2 DAAC 3 2 DAAC 3	2 DXYC 3 2 DAAC 3 2 DAAC 3	2 DXYC 5 2 DXCC 3 2 DAAC 3	2 DXYC 5 2 DXCC 5 2 DAAC 5	2 DXYC 5 2 DAAC 5	2 DXYC 5 2 DXCC 5 2 DAWC 5	2 DXYC 7½ 2 DXCC 7½ 2 DAWC 7½	2 DXYC 7½ 2 DXCC 7½ 2 DAWC 7½	2 DXYC 7 2 DAWC 1
175	1150 1450 1750 3500	3 DAAC 1 3 DAAC 1 3 DAAC 1	3 DAAC 1½ 3 DAAC 1½ 3 DAAC 1½	3 DAAC 1½ 3 DAAC 1½ 3 DAAC 1½	3 DAAC 2 3 DAAC 2 3 DAAC 1½	3 DAAC 2 3 DAAC 2 3 DAAC 2	2 DXYC 3 2 DAAC 3 2 DAAC 3	2 DXYC 3 2 DAAC 3 2 DAAC 3	2 DXYC 5 2 DAAC 3 2 DAAC 5	2 DXYC 5 2 DXCC 5 2 DAAC 5	2 DXYC 5 3 DXCC 5 2 DAAC 5	2 DXYC 7½ 2 DAAC 5	2 DXYC 7½ 2 DXCC 7½ 2 DAWC 7½	2 DXYC 7½ 2 DXCC 7½ 2 DAWC 7½	2 DXYC 7½ 2 DXYC 7½ 2 DAWC 10	2 DXYC 1 2 DAWC 1
200	1150 1450 1750 3500	3 DAAC 1 3 DAAC 1 3 DAAC 1	3 DAAC 1½ 3 DAAC 1½ 3 DAAC 1½	3 DAAC 2 3 DAAC 1½ 3 DAAC 1½	3 DAAC 2 3 DAAC 2 3 DAAC 2	3 DXCC 3 3 DAAC 2 3 DAAC 2	3 DXCC 3 3 DAAC 3 3 DAAC 3	3 DXCC 3 3 DAAC 3 3 DAAC 3	3 DXCC 5 3 DAAC 3 2 DAAC 3	3 DXYC 5 3 DXCC 5 2 DAAC 5	3 DXYC 5 3 DXCC 5 2 DAAC 5	3 DXYC 5 2 DXYC 7½ 2 DAAC 5	2 DXYC 7½ 2 DXCC 7½ 2 DAWC 7½	2 DXYC 7½ 2 DXYC 7½ 2 DAWC 7½	3 DXYC 10 2 DXYC 10 2 DAWC 10	2 DXYC 2 DAWC
225	1150 1450 1750 3500	3 DAAC 1½ 3 DAAC 1½ 3 DAAC 1½	3 DAAC 1½ 3 DAAC 1½ 3 DAAC 1½	3 DAAC 2 3 DAAC 2 3 DAAC 2	3 DAAC 2 3 DAAC 3 3 DAAC 2	3 DXCC 3 3 DAAC 3 3 DAAC 3	3 DXCC 3 3 DAAC 3 3 DAAC 3	3 DXCC 3 3 DAAC 3 3 DAAC 3	3 DXCC 5 3 DXCC 5 3 DAAC 5	3 DXYC 5 3 DXCC 5 3 DAAC 5	3 DXYC 5 3 DXCC 5 3 DAAC 5	3 DXYC 5 3 DXYC 7½ 3 DXCC 7½	3 DYPC 7½ 3 DXYC 7½ 3 DXCC 7½ 2 DAWC 7½	3 DYPC 10 3 DXYC 10 2 DXYC 7½ 2 DAWC 7½	3 DYPC 15 3 DXYC 10 2 DXYC 10 2 DAWC 10	3 DXYC 2 DXYC 2 DAWC
250	1150 1450 1750 3500	3 DAAC 1½ 3 DAAC 1½ 3 DAAC 1½	3 DAAC 2 3 DAAC 2 3 DAAC 2	3 DAAC 2 3 DAAC 2 3 DAAC 2	3 DAAC 3 3 DAAC 3 3 DAAC 3	3 DXCC 3 3 DAAC 3 3 DAAC 3	3 DXCC 5 3 DAAC 3 3 DAAC 3	3 DXCC 5 3 DAAC 5 3 DAAC 5	3 DXYC 5 3 DXCC 5 3 DAAC 5	3 DXYC 5 3 DXCC 5 3 DAAC 5	3 DXYC 7½ 3 DXCC 7½ 3 DAAC 7½	3 DXYC 7½ 3 DXYC 7½ 2 DXYC 7½	3 DYPC 10 3 DXYC 7½ 2 DXYC 10 2 DAWC 10	3 DYPC 10 3 DXYC 10 2 DXYC 10 2 DAWC 10	3 DYPC 15 3 DXYC 15 2 DXYC 10 2 DXAC 10	3 DXYC 2 DXYC 2 DXAC
300	1150 1450 1750	4 DXAC 1½ 3 DAAC 2 3 DAAC 2	4 DXAC 2 3 DAAC 3 3 DAAC 3	4 DXAC 3 3 DAAC 3 3 DAAC 3	4 DXAC 3 3 DAAC 3 3 DAAC 3	4 DXAC 3 3 DAAC 5 3 DAAC 5	4 DXYC 5 3 DAAC 5 3 DAAC 5	4 DXYC 5 3 DAAC 5 3 DAAC 5	4 DXYC 5 3 DXCC 5 3 DAAC 5	4 DXYC 7½ 3 DXCC 7½ 3 DAAC 7½	4 DXYC 7½ 3 DXCC 7½ 3 DAAC 7½	4 DXYC 7½ 3 DXYC 7½ 3 DXCC 10	4 DMPC 10 3 DXYC 10 3 DXCC 10	4 DMPC 10 3 DXYC 10 3 DXCC 10	4 DMPC 15 3 DXYC 15 3 DXCC 15	4 DMPC 3 DYPC 3 DXYC
350	1150 1450 1750	4 DXAC 2 3 DAAC 2 4 DAAC 3	4 DXAC 3 3 DAAC 3 4 DAAC 3	4 DXAC 3 3 DAAC 3 4 DAAC 3	4 DXAC 3 3 DAAC 5 3 DAAC 5	4 DXAC 5 3 DAAC 5 3 DAAC 5	4 DXYC 5 3 DAAC 5 3 DAAC 5	4 DXYC 5 3 DXCC 5 3 DAAC 5	4 DXYC 5 3 DXCC 5 3 DAAC 5	4 DXYC 7½ 3 DXCC 7½ 3 DAAC 7½	4 DXYC 7½ 3 DXCC 7½ 3 DXCC 7½	4 DXYC 10 3 DXYC 10 3 DXCC 10	4 DMPC 10 3 DXYC 10 3 DXCC 10	4 DMPC 15 3 DXYC 15 3 DXCC 10	4 DMPC 15 3 DXYC 15 3 DXCC 15	4 DMPC 3 DYPC 3 DXYC
400	1150 1450 1750	4 DXAC 2	4 DXAC 3 4 DXAC 3	4 DXAC 3 4 DXAC 3 4 DXAC 3	4 DXAC 5 4 DXAC 5 3 DAAC 5	4 DXYC 5 4 DXAC 5 3 DAAC 5	4 DXYC 5 4 DXAC 5 3 DAAC 5	4 DXYC 5 4 DXAC 7½ 3 DAAC 7½	4 DXYC 7½ 4 DXAC 7½ 3 DAAC 7½	4 DXYC 7½ 4 DXYC 7½ 3 DAAC 7½	4 DXYC 7½ 3 DXYC 10 3 DXCC 10	4 DXYC 10 3 DXYC 10 3 DXCC 10	4 DMPC 10 3 DXYC 10 3 DXCC 15	4 DMPC 15 3 DXYC 15 3 DXCC 15	4 DMPC 15 4 DXYC 15 3 DXYC 15	4 DMPC 4 DXYC 3 DXYC
450	1150 1450 1750	4 DXAC 3 4 DXAC 3	4 DXAC 3 4 DXAC 3	4 DXAC 5 4 DXAC 5 4 DXAC 5	4 DXAC 5 4 DXAC 5 4 DXAC 5	4 DXYC 5 4 DXAC 5 4 DXAC 5	4 DXYC 5 4 DXAC 5 4 DXAC 5	4 DXYC 7½ 4 DXAC 7½ 4 DXAC 7½	4 DXYC 7½ 4 DXAC 7½ 4 DXAC 7½	4 DXYC 7½ 4 DXYC 7½ 4 DXAC 7½	4 DXYC 10 3 DXYC 10 3 DXCC 10	4 DXYC 10 3 DXYC 10 3 DXCC 15	4 DMPC 15 3 DXYC 15 3 DXCC 15	4 DMPC 15 4 DXYC 15 3 DXCC 15	4 DMPC 15 4 DXYC 15 3 DXYC 20	4 DMPC 4 DXYC 3 DXYC
500	1150 1450 1750	4 DXAC 3 4 DXAC 3	4 DXAC 3 4 DXAC 3	4 DXAC 5 4 DXAC 5 4 DXAC 5	4 DXYC 5 4 DXAC 5 4 DXAC 5	4 DXYC 5 4 DXAC 5 4 DXAC 5	4 DXYC 7½ 4 DXAC 7½ 4 DXAC 7½	4 DXYC 7½ 4 DXAC 7½ 4 DXAC 7½	4 DXYC 7½ 4 DXYC 7½ 4 DXAC 10	4 DXYC 7½ 4 DXYC 10 4 DXAC 10	4 DXYC 10 4 DXYC 10 4 DXYC 10	4 DMPC 15 4 DXYC 15 3 DXYC 15	4 DMPC 15 4 DXYC 15 3 DXYC 15	4 DMPC 15 4 DXYC 15 3 DXYC 15	4 DMPC 20 4 DXYC 20 3 DXYC 20	4 DMPC 4 DXYC 3 DXYC
600	1150 1450 1750	4 DXAC 5 4 DXAC 5	4 DXYC 5 4 DXAC 5 4 DXAC 5	4 DXYC 5 4 DXAC 5 4 DXAC 5	4 DXYC 7½ 4 DXAC 7½ 4 DXAC 7½	4 DXYC 7½ 4 DXAC 7½ 4 DXAC 7½	4 DXYC 7½ 4 DXAC 7½ 4 DXAC 7½	4 DXYC 10 4 DXYC 10 4 DXAC 10	4 DXYC 10 4 DXYC 10 4 DXAC 10	4 DXYC 10 4 DXYC 10 4 DXAC 10	4 DXYC 15 4 DXYC 15 4 DXYC 15	4 DMPC 15 4 DXYC 15 4 DXYC 15	4 DMPC 15 4 DXYC 20 4 DXYC 20	4 DMPC 20 4 DXYC 20 4 DXYC 20	4 DMPC 20 4 DXYC 20 4 DXYC 20	4 DMPC 4 DMZC 4 DXYC
700	1150 1450 1750	5 DMYC 5 4 DXAC 7½	5 DMYC 5 4 DXAC 7½ 4 DXAC 7½	5 DMYC 7½ 4 DXAC 7½ 4 DXAC 7½	5 DMYC 7½ 5 DMYC 7½ 4 DXAC 7½	5 DMYC 7½ 5 DMYC 7½ 4 DXAC 7½	5 DMYC 10 5 DMYC 10 4 DXAC 10	5 DMYC 10 5 DMYC 10 4 DXAC 10	5 DMYC 15 5 DMYC 15 4 DXAC 15	5 DMYC 15 5 DMYC 15 4 DXYC 15	5 DMYC 15 5 DMYC 15 4 DXYC 15	4 DMPC 20 5 DMYC 20 4 DXYC 20	4 DMPC 20 5 DMYC 20 4 DXYC 20	4 DMPC 20 5 DMYC 25 4 DXYC 25	4 DMPC 25 5 DMYC 25 4 DXYC 25	4 DMPC 4 DMZC 4 DXYC
800	1150 1450 1750			6 DMYC 7½	6 DMYC 7½	6 DMYC 10 5 DMYC 10	5 DMYC 10 5 DMYC 15	5 DMYC 15 5 DMYC 15	5 DMYC 15 5 DMYC 15	5 DMYC 15 5 DMYC 15	5 DNZC 15 5 DMYC 15	5 DNZC 20 5 DMYC 20 5 DMYC 20	5 DNZC 25 5 DMYC 20 5 DMYC 20	5 DMYC 25 5 DMYC 25	5 DNZC 30 5 DMYC 30	5 DNZC 5 DMYC
1000	1150 1450 1750		6 DMYC 7½	6 DMYC 10 5 DMYC 10	6 DMYC 10 5 DMYC 15	6 DMYC 15 5 DMYC 15	6 DMYC 15 5 DMYC 15	5 DMYC 15 5 DMYC 15	5 DMYC 15 5 DMYC 20	5 DMYC 20 5 DMYC 20 5 DMYC 20	5 DNZC 25 5 DMYC 20 5 DMYC 20	5 DMYC 25 5 DMYC 25	5 DMYC 30 5 DMYC 30	5 DMYC 30 5 DMYC 30	5 DNZC 40 5 DMYC 40	5 DNZC 5 DMYC
1250	1150 1450 1750				6 DMYC 15 6 DMYC 15	6 DMYC 15 6 DMYC 15	6 DMYC 20 6 DMYC 15	6 DMYC 20 6 DMYC 20	6 DMYC 20 6 DMYC 20 5 DMYC 25	5 DMYC 25 5 DMYC 25	5 DMYC 30 5 DMYC 30	5 DMYC 30 5 DMYC 30	5 DMYC 40 5 DMYC 40	5 DNZC 50 5 DMYC 40	5 DNZC 50 5 DMYC 40	5 DNZC 5 DMYC

HEAD IN FEET

U.S. GALLONS PER MINUTE	SPEED R.P.M.	120	130	140	150	160	180	200	220	240	260	280	300	350	400	500
10	1150 1450 1750 3500	¾ DAYC 3 ¾ DAWC 2	¾ DAYC 3 ¾ DAWC 3	¾ DAYC 3 ¾ DAWC 3	¾ DAYC 5 ¾ DAWC 3	¾ DAYC 5 ¾ DAYC 5	¾ DAAC 3	¾ DAAC 5	¾ DAAC 5	¾ DAAC 5	¾ DAAC 5	¾ DAAC 7½	¾ DAAC 7½	¾ DACC 7½	¾ DACC 10	¾ DACC 10
15	1150 1450 1750 3500	¾ DAYC 3 ¾ DAWC 2	¾ DAYC 3 ¾ DAWC 3	¾ DAYC 5 ¾ DAWC 3	¾ DAYC 5 ¾ DAWC 3	¾ DAYC 5 ¾ DAAC 3	¾ DAAC 3	¾ DAAC 5	¾ DAAC 5	¾ DAAC 5	¾ DAAC 5	¾ DAAC 7½	¾ DACC 7½	¾ DACC 7½	¾ DACC 10	¾ DACC 10
20	1150 1450 1750 3500	1 DAYC 3 1 DAWC 2	1 DAYC 3 1 DAWC 2	1 DAYC 5 1 DAWC 2	1 DAYC 5 1 DAWC 3	1 DAYC 5 1 DAAC 3	¾ DAAC 5	¾ DAAC 5	¾ DAAC 5	¾ DAAC 5	¾ DAAC 5	¾ DAAC 7½	¾ DAAC 7½	¾ DACC 7½	¾ DACC 10	¾ D$_2$XAC 10
25	1150 1450 1750 3500	1¼ DAYC 5 1 DAYC 3 1 DAWC 2	1 DAYC 5 1 DAWC 2	1 DAYC 5 1 DAWC 3	1 DAYC 5 1 DAWC 3	1 DAYC 5 1 DAAC 5	1 DAAC 5	¾ DAAC 5	¾ DAAC 5	¾ DAAC 5	¾ DAAC 7½	¾ DAAC 7½	¾ DAAC 7½	¾ DACC 7½	¾ DACC 10	1 D$_2$XAC 15
30	1150 1450 1750 3500	1¼ DAYC 5 1 DAYC 5 1 DAWC 2	1 DAYC 5 1 DAWC 3	1 DAYC 5 1 DAWC 3	1 DAYC 5 1 DAAC 5	1¼ DAYC 5 1 DAAC 5	1 DAAC 5	1 DAAC 5	1 DAAC 5	1 DAAC 7½	¾ DAAC 7½	¾ DAAC 7½	¾ D$_2$XAC 7½	1 D$_2$XAC 10	1 D$_2$XAC 10	1 D$_2$XAC 15
35	1150 1450 1750 3500	1¼ DAYC 5 1 DAYC 5 1 DAWC 3	1 DAYC 5 1 DAWC 3	1 DAYC 5 1 DAWC 3	1 DAYC 5 1 DAAC 5	1¼ DAYC 5 1 DAAC 5	1 DAAC 5	1 DAAC 5	1 DAAC 7½	1 DAAC 7½	¾ DAAC 7½	¾ DAAC 7½	1 D$_2$XAC 10	1 D$_2$XAC 10	1 D$_2$XAC 10	1 D$_2$XAC 15
40	1150 1450 1750 3500	1¼ DAYC 5 1 DAYC 5 1 DAWC 3	1 DAYC 5 1 DAWC 3	1 DAYC 5 1 DAAC 5	1 DAYC 5 1 DAAC 5	1¼ DAYC 7½ 1 DAAC 5	1 DAAC 5	1 DAAC 7½	1 DAAC 7½	1 DAAC 7½	1 DAAC 7½	1¼ D$_2$XAC 7½	1¼ D$_2$XAC 10	1¼ D$_2$XAC 10	1¼ D$_2$XAC 15	1¼ D$_2$XAC 15
50	1150 1450 1750 3500	1½ DAYC 5 1¼ DAYC 5 1¼ DAWC 5	1¼ DAYC 5 1¼ DAWC 5	1¼ DAYC 5 1¼ DAAC 5	1¼ DAYC 7½ 1¼ DAAC 5	1¼ DAYC 7½ 1¼ DAAC 5	1¼ DAAC 7½	1¼ DAAC 7½	1¼ DAAC 7½	1¼ DAAC 10	1¼ DAAC 10	1¼ D$_2$XAC 10	1¼ D$_2$XAC 10	1¼ D$_2$XAC 15	1¼ D$_2$XAC 15	1¼ D$_2$XAC 15
60	1150 1450 1750 3500	1½ DAYC 5 1½ DAYC 5 1¼ DAWC 5	1½ DAYC 7½ 1¼ DAWC 5	1½ DAYC 7½ 1¼ DAAC 5	1½ DAYC 7½ 1¼ DAAC 5	1½ DAYC 7½ 1¼ DAAC 7½	1¼ DAAC 7½	1¼ DAAC 7½	1¼ DAAC 10	1¼ DAAC 10	1¼ DAAC 10	1¼ D$_2$XAC 10	1¼ D$_2$XAC 10	1¼ D$_2$XAC 15	1¼ D$_2$XAC 15	1½ D$_2$XAC 20
75	1150 1450 1750 3500	1½ DAYC 7½ 1½ DAWC 5	1½ DAYC 7½ 1½ DAWC 5	1½ DAYC 7½ 1½ DXAC 5	1½ DAYC 7½ 1½ DXAC 7½	1½ DAYC 7½ 1½ DXAC 7½	1½ DXAC 7½	1½ DXAC 7½	1½ DXAC 10	1½ DXAC 10	1½ D$_2$XAC 10	1½ D$_2$XAC 10	1½ D$_2$XAC 10	1½ D$_2$XAC 15	1½ D$_2$XAC 20	1½ D$_2$XAC 20
100	1150 1450 1750 3500	1½ DAYC 7½ 1½ DAWC 5	1½ DAYC 7½ 1½ DAWC 7½	1½ DAYC 7½ 1½ DXAC 7½	1½ DAYC 7½ 1½ DXAC 7½	1½ DXAC 7½	1½ DXAC 7½	1½ DXAC 10	1½ DXAC 10	1½ DXAC 15	1½ D$_2$XAC 15	1½ D$_2$XAC 15	1½ D$_2$XAC 15	1½ D$_2$XAC 20	1½ D$_2$XAC 20	1½ D$_2$XAC 25
125	1150 1450 1750 3500	2 DXYC 7½ 2 DAWC 7½	2 DXYC 7½ 2 DAWC 7½	2 DXYC 10 2 DXAC 7½	2 DXYC 10 2 DXAC 10	2 DXYC 10 2 DXAC 10	2 DXAC 10	2 DXAC 15	2 DXAC 15	2 DXAC 15	2 DXAC 15	2 DXCC 20	2 DXCC 25	2 DXCC 25		
150	1150 1450 1750 3500	2 DXYC 7½ 2 DAWC 7½	2 DXYC 10 2 DAWC 7½	2 DXYC 10 2 DXAC 10	2 DXYC 10 2 DXAC 10	2 DXYC 15 2 DXAC 10	2 DXAC 15	2 DXAC 15	2 DXAC 15	2 DXAC 15	2 DXAC 20	2 DXCC 25	2 DXCC 25	2 DXCC 30		
175	1150 1450 1750 3500	2 DXYC 10 2 DAWC 10	2 DXYC 10 2 DAWC 10	2 DXYC 15 2 DXAC 10	2 DXYC 15 2 DXAC 10	2 DXYC 15 2 DXAC 15	2 DXAC 15	2 DXAC 15	2 DXAC 15	2 DXAC 20	2 DXCC 25	2 DXCC 25	2 DXCC 30	2 DXCC 40		
200	1150 1450 1750 3500	2 DXYC 10 2 DXAC 10	2 DXYC 10 2 DXAC 10	2 DXYC 15 2 DXAC 10	2 DXYC 15 2 DXAC 15	2 DXYC 15 2 DXAC 15	2 DXAC 15	2 DXAC 20	2 DXAC 20	2 DXAC 20	2 DXCC 25	2 DXCC 30	2 DXCC 30	2 DXCC 40		
225	1150 1450 1750 3500	3 DYPC 15 2 DXYC 15 2 DXAC 10	3 DYPC 15 2 DXYC 15 2 DXAC 15	3 DYPC 15 2 DXYC 15 2 DXAC 15	3 DYPC 20 2 DXYC 15 2 DXAC 15	3 DYPC 20 3 DYPC 20 2 DXAC 15	3 DYPC 20 3 DYPC 20 2 DXAC 20	3 DYPC 25 2 DXAC 20	3 DYPC 25 2 DXAC 20	3 DYPC 30 2 DXCC 25	2 DXCC 30	2 DXCC 30	2 DXCC 40	2 DXCC 40		
250	1150 1450 1750 3500	3 DYPC 15 2 DXYC 15 2 DXAC 15	3 DYPC 15 2 DXYC 15 2 DXAC 15	3 DYPC 15 2 DXYC 15 2 DXAC 15	3 DYPC 20 2 DXYC 15 2 DXAC 20	3 DYPC 20 3 DYPC 20 2 DXAC 20	3 DYPC 20 3 DYPC 25 2 DXCC 25	3 DYPC 25 2 DXCC 25	3 DYPC 30 2 DXCC 30	3 DYPC 30 2 DXCC 30	2 DXCC 30	2 DXCC 40	2 DXCC 40	2 DXCC 40		
300	1150 1450 1750	4 DMPC 20 3 DYPC 20 3 DXYC 15	4 DMPC 20 3 DYPC 20 3 DXYC 15	3 DYPC 20 3 DXYC 20	3 DYPC 20 3 DXYC 20	3 DYPC 25 3 DYPC 25	3 DYPC 25	3 DYPC 30	3 DYPC 30	3 DYPC 40						
350	1150 1450 1750	4 DMPC 20 3 DYPC 20 3 DXYC 15	4 DMPC 20 3 DYPC 20 3 DXYC 15	4 DMPC 20 3 DXYC 20	4 DMPC 20 3 DXYC 20	4 DMPC 25 3 DYPC 25	4 DMPC 25 3 DYPC 30	4 DMPC 30 3 DYPC 30	3 DYPC 40	3 DYPC 40						
400	1150 1450 1750	4 DMPC 20 4 DMPC 20 3 DXYC 20	4 DMPC 20 4 DMPC 20 3 DXYC 20	4 DMPC 20 3 DXYC 20	4 DMPC 25 3 DXYC 20	4 DMPC 25 3 DYPC 25	4 DMPC 30 3 DYPC 30	4 DMPC 40 3 DYPC 40	3 DYPC 40	4 DMPC 40	4 DMPC 40	4 DMPC 50	4 DMPC 50			
450	1150 1450 1750	4 DMPC 20 4 DMPC 20 3 DXYC 20	4 DMPC 25 4 DMPC 20 3 DXYC 20	4 DMPC 25 3 DXYC 25	4 DMPC 25 3 DYPC 30	4 DMPC 30 3 DYPC 30	4 DMPC 30 3 DYPC 40	4 DMPC 40 3 DYPC 40	4 DMPC 40	4 DMPC 50	4 DMPC 50	4 DMPC 50	4 DMPC 60			
500	1150 1450 1750	4 DMPC 20 4 DMPC 25 3 DXYC 20	4 DMPC 25 3 DXYC 25	4 DMPC 25 3 DXYC 25	4 DMPC 30 4 DMPC 30	4 DMPC 30 4 DMPC 30	4 DMPC 40 4 DMPC 40	4 DMPC 40 4 DMPC 40	4 DMPC 50	4 DMPC 50	4 DMPC 50	4 DMPC 60	4 DMPC 60			
600	1150 1450 1750	4 DMPC 25 4 DXYC 25	4 DMPC 25 4 DXYC 30	4 DMPC 30 4 DXYC 30	4 DMPC 40 4 DMPC 40	4 DMPC 40 4 DMPC 40	4 DMPC 40 4 DMPC 40	4 DMPC 50 4 DMPC 50	4 DMPC 50	4 DMPC 60	4 DMPC 60	4 DMPC 60	4 DMPC 75			
700	1150 1450 1750	4 DMPC 30 4 DXYC 30	4 DMPC 30 4 DXYC 30	4 DMPC 30 4 DMPC 40	4 DMPC 40 4 DMPC 40	4 DMPC 40 4 DMPC 40	4 DMPC 50 4 DMPC 50	4 DMPC 50	4 DMPC 60	4 DMPC 60	4 DMPC 75	4 DMPC 75	4 DMPC 75			
800	1150 1450 1750	5 DNZC 40 5 DMYC 40	5 DNZC 40 5 DMYC 40	5 DNZC 40 5 DMYC 40	5 DNZC 50 5 DMYC 40	5 DNZC 50 5 DNZC 50	5 DNZC 50	5 DNZC 60	5 DNZC 75	5 DNZC 75						
1000	1150 1450 1750	5 DNZC 40 5 DMYC 40	5 DNZC 50 5 DMYC 50	5 DNZC 50 5 DMYC 50	5 DNZC 60	5 DNZC 60	5 DNZC 60	5 DNZC 75	5 DNZC 75							
1250	1150 1450 1750	5 DMYC 50	5 DMYC 50	5 DNZC 60	5 DNZC 75	5 DNZC 75	5 DNZC 75	5 DNZC 100								

KEY:

FIRST FIGURE: Size Discharge

LAST FIGURE: H.P. of Motor

CONVERSIONS:

1 U.S. GAL.* = .833 IMP GAL.

1 IMP. GAL. = 1.2 U.S. GALS.

1 LITER = .2642 U.S. GALS.

1 U.S. GAL. = 3.785 LITERS

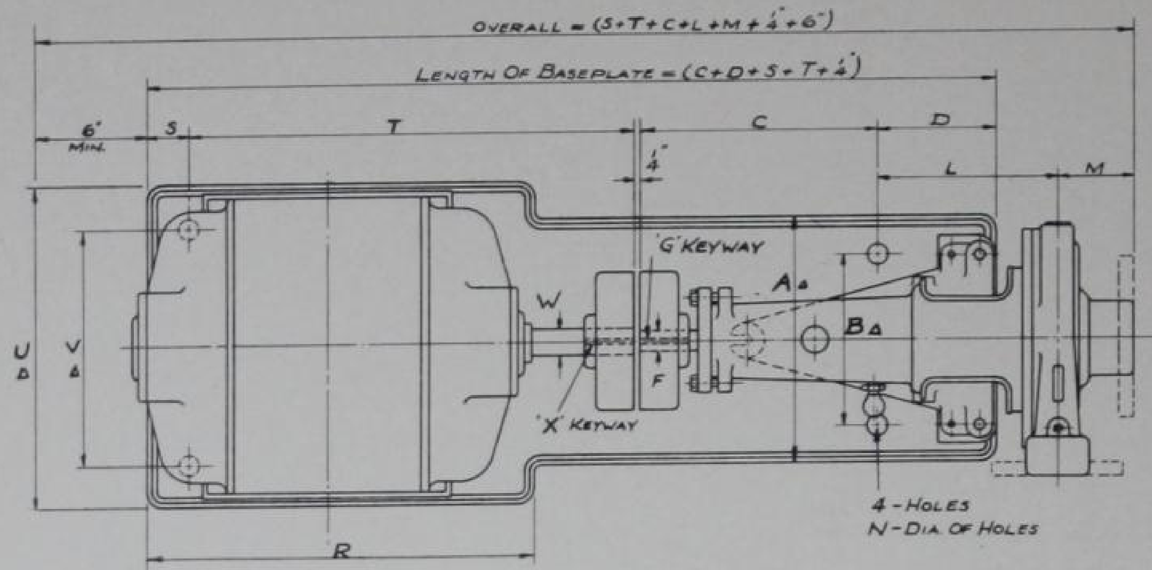
1 METER = 3.28 FEET

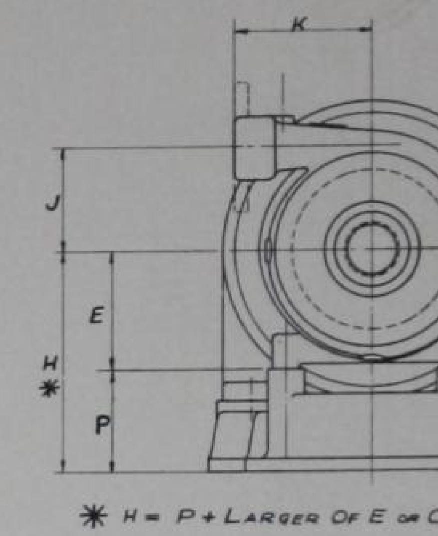
1 FOOT = .3048 METERS

* GAL. = GALLON

NOTE: WE RESERVE RIGHT TO CHANGE SIZE OF PUMP OR MOTOR.

TABLE No. 1



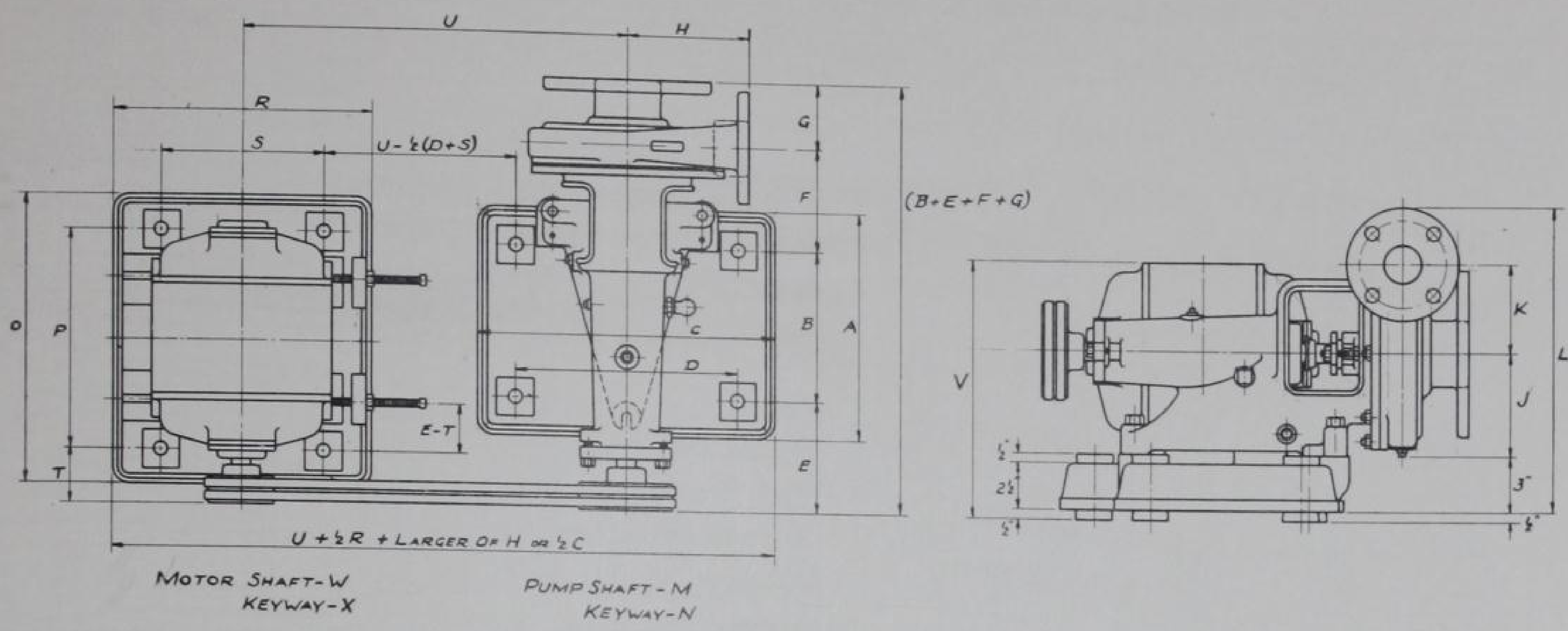


PIPE CONNECTIONS			'C' CLOSED IMP.					'O' OPEN IMP.					'S' SCREENLESS IMP					FOR ALL TYPES OF IMPELLERS							Deep Gland Spec. or F... Add "L"
Discharge	Suction	Suc. & Disc. Connections	Class	J	K	L	M	Class	J	K	L	M	Class	J	K	L	M	A*	B*	C	D	E	F	G	
¾"	1"	THREADED CONNECTIONS (FLANGED CONNECTIONS SPECIAL)	¾" DWWC	3⅝"	5"	6 9/16"	2½"	¾" DWWO	3⅝"	5"	7"	2 13/32"						10½"	7"	8½"	4½"	5"	⅝"	¼" x ⅛"	
¾"	1"		¾" DAWC	3⅝"	5"	8⅞"	2½"	¾" DAWO	3⅝"	5"	8⅜"	2 13/32"						11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
¾"	1"		¾" DAAC	4 11/32"	5¾"	8⅜"	2⅝"	¾" DAAO	4½"	5⅛"	8⅜"	3 5/32"						11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
¾"	1"		¾" DACC	5⅜"	7"	8⅞"	2¾"											11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
¾"	1"		¾" DAYC	6⅜"	7⅜"	8⅞"	2⅞"											11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
1"	1¼"		1" DWWC	3⅝"	5"	6 9/16"	2½"	1" DWWO	3⅝"	5"	7¼"	3⅜"						10½"	7"	8½"	4½"	5"	⅝"	¼" x ⅛"	
1"	1¼"		1" DAWC	3⅝"	5"	8⅞"	2½"	1" DAWO	3⅝"	5"	8⅜"	3⅜"						11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
1"	1¼"		1" DAAC	4⅝"	5¾"	8⅜"	2 13/32"	1" DAAO	4 5/32"	6⅜"	8⅜"	3 23/32"						11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
1"	1¼"		1" DACC	5⅝"	6¾"	8⅜"	2 13/32"											11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
1"	1¼"		1" DAYC	6⅞"	7⅜"	8⅞"	2⅞"											11½"	8"	10¾"	5½	5½"	⅝"	¼" x ⅛"	
1¼"	1½"		1¼" DWWC	3⅝"	5"	6 9/16"	2⅝"											10½"	7"	8½"	4½"	5"	⅝"	¼" x ⅛"	
1¼"	1½"		1¼" DAWC	3⅝"	5"	8⅞"	2⅝"											11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
1¼"	1½"		1¼" DAAC	4⅝"	5¾"	8⅜"	2 13/32"	1¼" DAAO	4⅝"	5¾"	8¼"	2 13/32"						11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
1¼"	1½"		1¼" DACC	5⅝"	7"	8⅝"	2 13/32"											11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
1¼"	1½"		1¼" DAYC	6½"	8"	8⅞"	2⅝"											11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
1½"	2"		1½" DWWC	3⅞"	5¼"	7"	2⅞"											10½"	7"	8½"	4½"	5"	⅝"	¼" x ⅛"	
1½"	2"		1½" DAWC	3⅞"	5¼"	8⅝"	2⅞"											11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
1½"	2"		1½" DAAC	4 23/32"	5¾"	8⅞"	2¼"	1½" DAAO	4 23/32"	5¾"	8½"	2½"						11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
1½"	2"		1½" DXAC	4 23/32"	5¾"	9⅝"	2¼"	1½" DXAO	4 23/32"	5¾"	9⅝"	2½"						11½"	8"	13"	7"	7"	1⅛"	¼" x ⅛"	
1½"	2"		1½" DACC	5¾"	7"	8⅝"	2¼"											11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
1½"	2"		1½" DAYC	6⅝"	8"	8⅞"	2⅝"	1½" DAYO	6⅝"	8¼"	8⅜"	2⅜"						11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
2"	3"	FLANGED CONNECTIONS	2" DWWC	4⅛"	5½"	7 3/32"	3 3/32"											10½"	7"	8½"	4½"	5"	⅝"	¼" x ⅛"	
2"	3"		2" DAWC	4⅛"	5½"	8 23/32"	3 3/32"											11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
2"	3"		2" DAAC	5 3/32"	6½"	8 23/32"	3½"	2" DAAO	5⅛"	6½"	8¾"	3½"	2" DAAS	5¼"	8"	9⅜"	4½"	11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
2"	3"		2" DXAC	5 3/32"	6½"	10 3/32"	3½"	2" DXAO	5⅛"	6½"	10⅜"	3½"	2" DXAS	5¼"	8"	10⅝"	4½"	11½"	8"	13"	7"	7"	1⅛"	¼" x ⅛"**	
2"	3"		2" DXCC	5 3/32"	7"	10⅛"	3⅞"	2" DXCO	6⅛"	7⅛"	10⅝"	3½"						11½"	8"	13"	7"	7"	1⅛"	¼" x ⅛"	
2"	3"		2" DXYC	7"	8"	10⅛"	4"	2" DXYO	7⅛"	8¼"	10¼"	3⅝"						11½"	8"	13"	7"	7"	1⅛"	¼" x ⅛"	
3"	4"		3" DAAC	5¾"	7"	8⅞"	4¼"	3" DAAO	5 23/32"	7"	9⅛"	4¼"	3" DAAS	5⅝"	9½"	9⅞"	5¼"	11½"	8"	10¾"	5½"	5½"	⅝"	¼" x ⅛"	
3"	4"		3" DXAC	5¾"	7"	10⅜"	4¼"	3" DXAO	5 23/32"	7"	10½"	4¼"	3" DXAS	5⅝"	9½"	11⅝"	5¼"	11½"	8"	13"	7"	7"	1⅛"	¼" x ⅛"	
3"	4"		3" DXCC	6¾"	7¼"	10¼"	4¼"											11½"	8"	13"	7"	7"	1⅛"	¼" x ⅛"	
3"	4"		3" DXYC	7¼"	8"	10¼"	4"						3" DXYS	8¼"	11"	12¼"	5⅝"	11½"	8"	13"	7"	7"	1⅛"	¼" x ⅛"	
3"	4"		3" DYZC	10¼"	9"	11⅝"	4⅝"											12½"	8½"	14¼"	7½"	8"	1¼"	¼" x ⅛"	
4"	5"		4" DXAC	6"	8"	11⅛"	5¾"						4" DXAS	6¼"	10"	11⅜"	6"	11½"	8"	13"	7"	7"	1⅛"	¼" x ⅛"**	
4"	5"		4" DXYC	8⅜"	9"	10⅞"	5½"						4" DXYS	8¼"	11"	12⅝"	6¼"	11½"	8"	13"	7"	7"	1⅛"	¼" x ⅛"	
4"	5"		4" DMPC	9¾"	11"	11⅝"	6⅝"											12½"	8½"	14¼"	7½"	8"	1⅝"	⅜" x 3/32"	
5"	6"		5" DMYC	8¼"	10"	12⅛"	6"						5" DMYS	8¼"	11"	13⅞"	6¼"	12½"	8½"	14¼"	7½"	8"	1⅝"	⅜" x 3/32"	
5"	6"		5" DNZC	10⅛"	12"	13⅝"	6"											20"	15"	25¼"	8"	11"	2¼"	½" x ¼"	
6"	8"		6" DMYC	8¼"	10"	12⅝"	7"						6" DMYS	8¼"	12½"	14⅛"	7½"	12½"	8½"	14¼"	7½"	8"	1⅝"	⅜" x 3/32"	
6"	8"		6" DNZC	9¾"	13"	14⅝"	7"						6" DNZS	9¾"	13"	14⅝"	7"	20"	15"	25¼"	8"	11"	2¼"	½" x ¼"	

*NOTE—STRAIGHT BASE—WHEN A = U & B = V OR WHEN DIFFERENCE BETWEEN A & U OR B & V IS 2½" OR LESS — TAKE LARGER OF A or U and B or V

H.P. AT 900 R.P.M.	H.P. AT 1200 R.P.M.	H.P. AT 1500 R.P.M.	H.P. AT 1800 R.P.M.	H.P. AT 3600 R.P.M.	MOTOR FRAME No.	N	O	P	R	S	T	U*	V*	W	X
	¾		1	1½	203	¾"	5"	3¼"	—	1¾"	15⅜"	10½"	7"	¾"	⅛" x
½	1	1	1½	2	204	¾"	5"	3¼"	—	1¾"	15⅜"	10½"	7"	¾"	⅛" x
¾	1½	1½	2	3	224	¾"	5½"	3¼"	—	1¾"	17⅜"	11½"	8"	1"	¼" x
1	2	2	3	5	225	¾"	5½"	3¼"	—	1¾"	17⅜"	11½"	8"	1"	¼" x
1½ , 2	3	3	5	7½	254	⅞"	6¼"	3¼"	18¼"	2"	21⅛"	15"	11"	1⅛"	¼" x
3	5	5	7½	10	284	⅞"	7"	3¼"	18¼"	2"	21⅛"	15"	11"	1⅛"	¼" x
5	7½	7½	10	15	324	⅞"	8"	3½"	20½"	2"	25⅜"	17"	13"	1⅜"	¼" x
7½	10	10	15	20	326	⅞"	8"	3½"	20½"	2"	25⅜"	17"	13"	1⅜"	⅜" x
10	15		20 , 25	25 , 30	364	⅞"	9"	4"	21¾"	2"	27⅜"	18¾"	14¾"	1⅝"	⅜" x
15	20	15	30	40	365	⅞"	9"	4"	21¾"	2"	27⅜"	18¾"	14¾"	1⅝"	⅜" x
20	25	20	40	50	404	⅞"	10"	4½"	25½"	2"	30½"	21"	17"	2⅛"	½" x
25	30	25	50	60	405	⅞"	10"	4½"	25½"	2"	30½"	21"	17"	2⅛"	½" x
30	40	30	60	75	444	⅞"	11"	5"	29½"	2"	34¾"	24"	20"	2⅜"	½" x
40	50	40	75	100	445	⅞"	11"	5"	29½"	2"	34¾"	24"	20"	2⅜"	⅝" x
50	60	50	100	125	504	1"	12½"	6½"	29"	2½"	34½"	27"	22"	2⅞"	¾" x
60	75	60	125		505	1"	12½"	6½"	29"	2½"	34½"	27"	22"	2⅞"	¾" x

TABLE No. 2



* Add ⅜" to Dim. 'E' When Used With Motors Marked With ▲
Add 1 [illegible]" to Dim. 'E' When Used With Motor Marked With ⊙

SIZE	SUCTION		A	B	C	D	E*	F	G	H	J	K	L	M	N
¾" DWWC	1"	THREADED CONNECTIONS (Flanged Connections Special)	9¾"	6"	14¼"	10½"	5⅜"	3 15/16"	2½"	5"	5"	3⅝"	12 9/16"	15/16"	¼" x ⅛"
¾" DAAC	1"		12"	8"	15¾"	11¾"	5¾"	5 7/16"	2 9/16"	5¾"	5½"	4 13/32"	13⅞"	15/16"	¼" x ⅛"
1" DWWC	1¼"		9¾"	6"	14¼"	10½"	5⅜"	3 15/16"	2½"	5"	5"	3⅝"	12¾"	15/16"	¼" x ⅛"
1" DAAC	1¼"		12"	8"	15¾"	11¾"	5¾"	5 7/16"	2 13/32"	5¾"	5½"	4 9/16"	14 5/16"	15/16"	¼" x ⅛"
1¼" DWWC	1½"		9¾"	6"	14¼"	10½"	5⅜"	3 15/16"	2 9/16"	5"	5"	3 11/16"	13"	15/16"	¼" x ⅛"
1¼" DAAC	1½"		12"	8"	15¾"	11¾"	5¾"	5 7/16"	2 13/32"	5¾"	5½"	4 9/16"	14 5/16"	15/16"	¼" x ⅛"
1½" DWWC	2"		9¾"	6"	14¼"	10½"	5⅜"	4⅛"	2 7/16"	5¼"	5"	3⅞"	13 5/16"	15/16"	¼" x ⅛"
1½" DAAC	2"		12"	8"	15¾"	11¾"	5¾"	5½"	2¼"	5¾"	5½"	4 23/32"	14¾"	15/16"	¼" x ⅛"
2" DWWC	3"	FLANGED CON-NECTIONS	9¾"	6"	14¼"	10½"	5⅜"	4 13/32"	3 9/32"	5½"	5"	4⅛"	15⅛"	15/16"	¼" x ⅛"
2" DAAC	3"		12"	8"	15¾"	11¾"	5¾"	5 23/32"	3½"	6½"	5½"	5 7/32"	16¾"	15/16"	¼" x ⅛"
3" DAAC	4"		12"	8"	15¾"	11¾"	5¾"	5 15/16"	4¼"	7"	5½"	5¾"	18"	15/16"	¼" x ⅛"
4" DXAC	5"		14"	10"	17"	13"	7⅝"	6 7/16"	5¾"	8"	7"	6"	20½"	1⅛"	¼" x ⅛"

H.P. at 900 R.P.M.	H.P. at 1200 R.P.M.	H.P. at 1500 R.P.M.	H.P. at 1800 R.P.M.	MOTOR FRAME No.	O	P	R	S	T	U	V	W	X
	¾		1	203	13¾"	10"	12"	8¼"	3⅛"	20¼"	13⅜"	¾"	3/16" x 3/32"
½	1	1	1½	204	15¼"	11½"	13½"	8½"	2⅞"	22⅝"	13¼"	¾"	3/16" x 3/32"
¾	1½	1½	2	224	16¼"	12½"	15"	11¼"	3⅜"	22⅝"	14¾"	1"	¼" x ⅛"
1	2	2	3	225	16¼"	12½"	15"	11¼"	4"	22⅝"	14¾"	1"	¼" x ⅛"
1½, 2	3	3	5▲	254	19½"	15½"	17¼"	13¼"	4"	23"	16⅛"	1⅛"	¼" x ⅛"
3	5▲	5▲	7½⊙	284	19½"	15½"	17¼"	13¼"	5½"	23"	17⅝"	1¼"	¼" x ⅛"

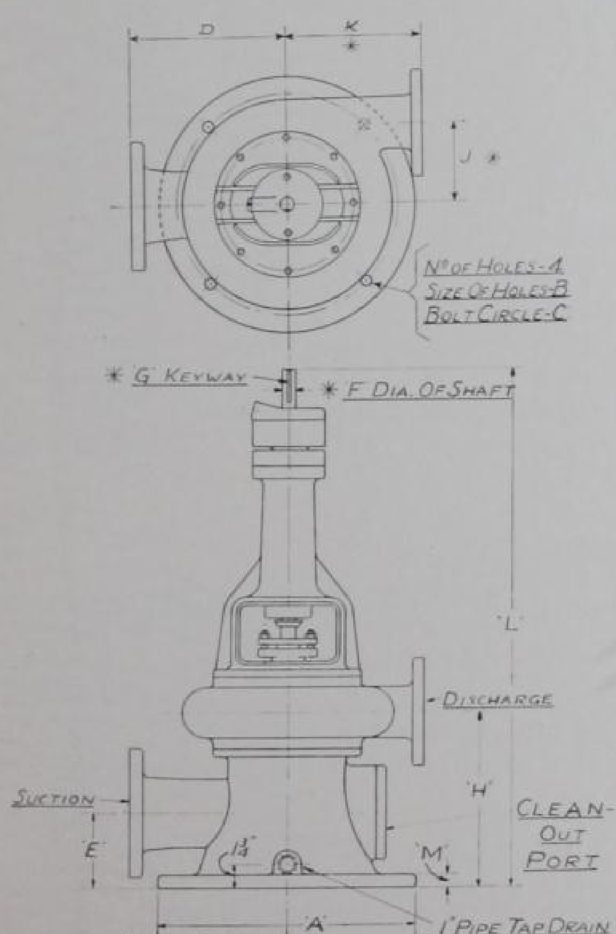


TABLE No. 3

* SEE TABLE No. 1 ON PAGE 15 FOR THESE DIMENSIONS.

PIPE CONNECTIONS		'C' CLOSED IMPELLER			'O' OPEN IMPELLER			'S' SCREENLESS IMPELLER			FOR ALL TYPES OF IMPELLERS					
Discharge	Suction	Class	H	L	Class	H	L	Class	H	L	A	B	C	D	E	M
1½"	2"	1½" DAAC-U	8"	27¼"	1½" DAAO-U	7⅞"	27⅛"				18"	¾"	15¾"	9⅜"	3½"	¾"
1½"	2"	1½" DXAC-U	8"	30⅞"	1½" DXAO-U	7⅞"	30⅞"				18"	¾"	15¾"	9⅜"	3½"	¾"
1½"	2"	1½" DACC-U	7 [illegible]"	27½"							18"	¾"	15¾"	9⅜"	3½"	¾"
1½"	2"	1½" DAYC-U	7 [illegible]"	27"	1½" DAYO-U	7⅞"	28"				18"	¾"	15¾"	9⅜"	3½"	¾"
2"	3"	2" DAAC-U	9 [illegible]"	29¼"	2" DAAO-U	9 [illegible]"	29"	2" DAAS-U	10⅛"	33 [illegible]"	18"	¾"	15¾"	10"	4½"	1"
2"	3"	2" DXAC-U	9 [illegible]"	32⅞"	2" DXAO-U	9 [illegible]"	32¾"	2" DXAS-U	10⅛"	37 [illegible]"	18"	¾"	15¾"	10"	4½"	1"
2"	3"	2" DXCC-U	9¾"	32⅞"	2" DXCO-U	9 [illegible]"	33⅛"				18"	¾"	15¾"	10"	4½"	1"
2"	3"	2" DXYC-U	10"	33⅛"	2" DXYO-U	9 [illegible]"	32⅝"				18"	¾"	15¾"	10"	4½"	1"
3"	4"	3" DAAC-U	11⅝"	31 [illegible]"	3" DAAO-U	11¾"	31 [illegible]"	3" DAAS-U	12 [illegible]"	36½"	18"	¾"	15¾"	11"	5¼"	1"
3"	4"	3" DXAC-U	11⅝"	35"	3" DXAO-U	11¾"	35¼"	3" DXAS-U	12 [illegible]"	40⅜"	18"	¾"	15¾"	11"	5¼"	1"
3"	4"	3" DXCC-U	11⅝"	34⅛"							18"	¾"	15¾"	11"	5¼"	1"
3"	4"	3" DXYC-U	11⅝"	35⅛"							18"	¾"	15¾"	11"	5¼"	1"
3"	4"							3" DYYS-U	12½"	43 [illegible]"	18"	¾"	15¾"	11"	5¼"	1"
3"	4"	3" DYZC-U	12"	37½"							18"	¾"	15¾"	11"	5¼"	1"
4"	5"	4" DXAC-U	12⅜"	36½"				4" DXAS-U	13"	41⅜"	18"	¾"	15¾"	11"	5¼"	1"
4"	5"	4" DXYC-U	12⅛"	35¾"							18"	¾"	15¾"	11"	5¼"	1"
4"	5"							4" DYYS-U	13⅜"	45"	18"	¾"	15¾"	11"	5¼"	1"
4"	5"	4" DMPC-U	13 [illegible]"	39⅝"							24"	⅞"	21"	14"	5½"	1¼"
5"	6"	5" DMYC-U	14⅜"	41"				5" DMYS-U	15¼"	47⅛"	18"	¾"	15¾"	12"	6"	1"
5"	6"	5" DNZC-U	14½"	53½"							24"	⅞"	21"	15"	6¼"	1¼"
6"	8"	6" DMYC-U	18⅛"	45"				6" DMYS-U	18⅝"	51⅛"	24"	⅞"	21"	15"	7½"	1¼"
6"	8"	6" DNZC-U	18 [illegible]"	58¾"				6" DNZS-U	18 [illegible]"	62 [illegible]"	24"	⅞"	21"	15"	7½"	1¼"

THEORETICAL DISCHARGE OF NOZZLES IN U.S. GALLONS PER MINUTE

HEAD		Velocity of Discharge Feet per Sec.	DIAMETER OF NOZZLE IN INCHES									
Pounds	Feet		⅜	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	½
10	23.1	38.6	13.3	23.6	36.9	53.1	72.4	94.5	120	148	179	213
15	34.6	47.25	16.3	28.9	45.2	65.0	88.5	116.	147	181	219	260
20	46.2	54.55	18.8	33.4	52.2	75.1	102.	134.	169	209	253	301
25	57.7	61.0	21.0	37.3	58.3	84.0	114.	149.	189	234	283	336
30	69.3	66.85	23.0	40.9	63.9	92.0	125.	164.	207	256	309	368
35	80.8	72.2	24.8	44.2	69.0	99.5	135.	177.	224	277	334	398
40	92.4	77.2	26.6	47.3	73.8	106.	145.	189.	239	296	357	425
45	103.9	81.8	28.2	50.1	78.2	113.	153.	200.	253	313	379	451
50	115.5	86.25	29.7	52.8	82.5	119.	162.	211.	267	330	399	475
55	127.0	90.4	31.1	55.3	86.4	125.	169.	221.	280	346	418	498
60	138.6	94.5	32.5	57.8	90.4	130.	177.	231.	293	362	438	521
65	150.1	98.3	33.8	60.2	94.0	136.	184.	241.	305	376	455	542
70	161.7	102.1	35.2	62.5	97.7	141.	191.	250.	317	391	473	563
75	173.2	105.7	36.4	64.7	101.	146.	198.	259.	327	404	489	582
80	184.8	109.1	37.6	66.8	104.	150.	205.	267.	338	418	505	602
85	196.3	112.5	38.8	68.9	108.	155.	211.	276.	349	431	521	620
90	207.9	115.8	39.9	70.8	111.	160.	217.	284.	359	443	536	638
95	219.4	119.0	41.0	72.8	114.	164.	223.	292.	369	456	551	656
100	230.9	122.0	42.1	74.7	117.	168.	229.	299.	378	467	565	672
105	242.4	125.0	43.1	76.5	120.	172.	234.	306.	388	479	579	689
110	254.0	128.0	44.1	78.4	122.	176.	240.	314.	397	490	593	705
115	265.5	130.9	45.1	80.1	125.	180.	245.	320.	406	501	606	720
120	277.1	133.7	46.0	81.8	128.	184.	251.	327.	414	512	619	736

NOTE: The actual quantities will vary from these figures, the amount of variation depending upon the shape of nozzle and size of pipe at the point where the pressure is determined. With smooth taper nozzles the actual discharge is about 94 per cent of the figures given in the tables.

WATER HEAD IN FEET WITH EQUIVALENT IN POUNDS PRESSURE PER SQUARE INCH

Head	Pressure	Head	Pressure	Head	Pressure	Head	Pressure	Head	Pressure	Head	Pressure	Head	Pressure
1	.434	21	9.11	41	17.79	61	26.47	81	35.15	105	45.57	210	91.14
2	.868	22	9.54	42	18.22	62	26.90	82	35.58	110	47.74	220	95.48
3	1.30	23	9.88	43	18.66	63	27.34	83	36.02	115	50.91	230	99.95
4	1.73	24	10.41	44	19.09	64	27.76	84	36.45	120	52.08	240	104.15
5	2.17	25	10.85	45	19.53	65	28.21	85	36.89	125	54.25	250	108.50
6	2.50	26	11.06	46	19.94	66	28.64	86	37.32	130	56.45	260	112.84
7	3.03	27	11.71	47	20.39	67	29.07	87	37.75	135	58.62	270	117.66
8	3.47	28	12.15	48	20.83	68	29.51	88	38.29	140	60.76	280	121.52
9	3.90	29	12.58	49	21.26	69	29.94	89	38.62	145	63.93	290	125.86
10	4.34	30	13.02	50	21.70	70	30.38	90	39.06	150	65.10	300	130.50
11	4.77	31	13.45	51	22.17	71	30.81	91	39.49	155	67.27	350	152.20
12	5.20	32	13.88	52	22.56	72	31.24	92	39.92	160	69.44	400	173.60
13	5.65	33	14.32	53	22.90	73	31.68	93	40.36	165	71.61	450	195.30
14	6.07	34	14.75	54	23.43	74	32.11	94	40.79	170	73.78	500	217.00
15	6.51	35	15.19	55	23.87	75	32.55	95	41.23	175	76.90	600	260.40
16	6.94	36	15.62	56	24.30	76	32.98	96	41.66	180	78.12	700	303.80
17	7.37	37	16.05	57	24.73	77	33.41	97	42.09	185	80.29	800	347.20
18	7.81	38	16.49	58	25.17	78	33.85	98	42.53	190	82.46	900	390.60
19	8.24	39	16.92	59	25.60	79	34.28	99	42.96	195	84.63	1000	434.00
20	8.68	40	17.36	60	26.04	80	34.72	100	43.40	200	86.80	1500	651.00

RELATIVE QUANTITIES OF WATER

Delivered in 1 Minute, in 1 Hour and in 24 Hours.

Gals. In 1 Min.	Gals. In 1 Hour	Gals. In 24 Hours	Gals. In 1 Min.	Gals. In 1 Hour	Gals. In 24 Hours	Gals. In 1 Min.	Gals. In 1 Hour	Gals. In 24 Hours
3.4	208	5,000	138.8	8,333	200,000	486.1	29,166	700,000
6.9	416	10,000	173.6	10,416	250,000	520.8	31,250	750,000
10.4	625	15,000	208.3	12,500	300,000	555.5	33,333	800,000
13.8	833	20,000	243.0	14,583	350,000	590.2	35,416	850,000
17.3	1,041	25,000	277.7	16,666	400,000	625.0	37,500	900,000
34.7	2,083	50,000	312.5	18,750	450,000	659.7	39,583	950,000
41.6	2,500	60,000	347.2	20,833	500,000	694.3	41,666	1,000,000
52.9	3,125	75,000	381.9	22,916	550,000	1,041.7	62,500	1,500,000
69.4	4,166	100,000	416.7	25,000	600,000	1,388.0	83,333	2,000,000
104.1	6,250	150,000	451.3	27,083	650,000	1,736.0	104,166	2,500,000

WATER REQUIRED PER MINUTE TO FEED BOILERS

(Using the "Centennial Standard" — 30 pounds or 3.6 gallons of water per horsepower per hour, evaporated from 100°F. to 70 pounds steam pressure per square inch.

H.P. Boiler	Feed Water U.S. Gallons	H.P. Boiler	Feed Water U.S. Gallons	H.P. Boiler	Feed Water U.S. Gallons	H.P. Boiler	Feed Water U.S. Gallons	H.P. Boiler	Feed Water U.S. Gallons
20	1.2	60	3.6	110	6.6	190	11.4	400	24.0
25	1.5	65	3.9	120	7.2	200	12.0	450	27.0
30	1.8	70	4.2	130	7.8	225	13.5	500	30.0
35	2.1	75	4.5	140	8.4	250	15.0	600	36.0
40	2.4	80	4.8	150	9.0	275	16.5	700	42.0
45	2.7	85	5.1	160	9.6	300	18.0	800	48.0
50	3.0	90	5.4	170	10.2	325	19.5	900	54.0
55	3.3	100	6.0	180	10.8	350	21.0	1000	60.0

An allowance has to be made on above figures as boilers are often driven beyond their nominal rating.

FRICTION OF WATER IN PIPES

Loss of Head in Feet Due to Friction, per 100 Feet of 15 year old Ordinary Iron Pipe

Vel.—Velocity in Feet per Second Fric.—Friction Head in Feet

U.S. Gallons per Minute	¾" Pipe		1" Pipe		1¼" Pipe		1½" Pipe		2" Pipe		2½" Pipe		3" Pipe		4" Pipe		5" Pipe		6" Pipe		8" Pipe		10" Pipe		12" Pipe	
	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.
1																										
2	1.20	1.9																								
3	1.80	4.1	1.12	1.26																						
4	2.41	7.0	1.49	2.14	0.86	0.57	0.63	0.26																		
5	3.01	10.5	1.86	3.25	1.07	0.84	0.79	0.39																		
10	6.02	38.0	3.72	11.7	2.14	3.05	1.57	1.43	1.02	0.50	0.65	0.17	0.45	0.07												
15	9.02	80.0	5.60	25.0	3.2	6.50	2.36	3.0	1.53	1.08	0.98	0.36	0.68	0.15												
20	12.03	136.0	7.44	42.0	4.29	11.1	3.15	5.2	2.04	1.82	1.31	0.61	0.91	0.25												
25			9.30	64.0	5.36	16.6	3.94	7.8	2.55	2.73	1.63	0.92	1.13	0.38												
30			11.15	89.0	6.43	23.5	4.72	11.0	3.06	3.84	1.96	1.29	1.36	0.54												
35			13.02	119.0	7.51	31.2	5.51	14.7	3.57	5.1	2.29	1.72	1.59	0.71												
40			14.88	152.0	8.58	40.0	6.3	18.8	4.08	6.6	2.61	2.20	1.82	0.91	1.02	0.22										
45					9.65	50.0	7.08	23.2	4.60	8.2	2.94	2.80	2.05	1.15	1.17	0.28										
50					10.72	60.0	7.87	28.4	5.11	9.9	3.27	3.32	2.27	1.38	1.28	0.34										
60					12.87	85.0	9.44	39.6	6.13	13.9	3.92	4.65	2.72	1.92	1.53	0.47	0.98	0.16								
75							11.80	60.0	7.66	20.9	5.01	7.1	3.4	3.05	1.92	0.73	1.22	0.24								
100							15.74	102.0	10.21	35.8	6.54	12.0	4.54	4.96	2.55	1.23	1.63	0.39	1.14	0.14						
120							18.89	143.0	12.25	50.0	7.84	16.8	5.45	7.0	3.06	1.71	1.96	0.57	1.42	0.25						
140							22.04	190.0	14.30	67.0	9.15	22.3	6.35	9.2	3.57	2.28	2.29	0.76	1.58	0.31						
160									16.34	86.0	10.46	29.0	7.26	11.8	4.08	2.91	2.61	0.98	1.80	0.41						
180									18.38	107.0	11.76	35.7	8.17	14.8	4.60	3.61	2.94	1.22	2.04	0.50						
200									20.42	129.0	13.07	43.1	9.08	17.8	5.11	4.37	3.27	1.48	2.28	0.62						
225											14.71	54.3	10.02	22.3	5.77	5.45	3.67	1.86	2.57	0.74						
250											16.03	66.0	11.32	27.2	6.40	6.72	4.08	2.24	2.80	0.92	1.60	0.22				
275											18.30	81.0	12.50	32.5	7.03	7.99	4.50	2.72	3.06	1.15	1.73	0.27				
300											19.61	92.0	13.62	38.0	6.76	9.30	4.90	3.14	3.40	1.29	1.90	0.32				
350															8.90	12.32	5.72	4.19	3.98	1.75	2.20	0.42				
400															10.21	16.00	6.54	5.40	4.54	2.21	2.60	0.54				
450															11.50	19.80	7.35	6.70	5.12	2.65	2.92	0.68	1.80	0.21		
475															12.20	22.96	7.76	7.42	5.55	2.95	3.10	0.76	1.94	0.25		
500															12.77	24.00	8.17	8.12	5.60	3.30	3.20	0.82	2.04	0.28	1.42	0.11
550																	8.99	9.60	6.16	3.93	3.52	0.97	2.25	0.33	1.57	0.14
600																	9.80	11.30	6.72	4.70	3.84	1.14	2.46	0.39	1.71	0.15
650																	10.62	13.20	7.28	5.40	4.16	1.34	2.66	0.46	1.85	0.19
700																	11.44	15.10	7.84	6.20	4.46	1.54	2.86	0.52	2.00	0.22
800																			9.08	8.00	5.12	1.97	3.28	0.67	2.27	0.27
900																			10.30	10.11	5.75	2.49	3.68	0.83	2.56	0.34
1000																			11.32	12.04	6.40	3.02	4.08	1.01	2.84	0.41
1100																			12.50	14.31	7.03	3.51	4.50	1.20	3.13	0.49
1200																			13.52	16.69	7.67	4.26	4.91	1.46	3.41	0.57
1500																					9.60	6.27	6.10	2.09	4.20	0.85
2000																					12.70	10.71	8.10	3.50	5.60	1.43

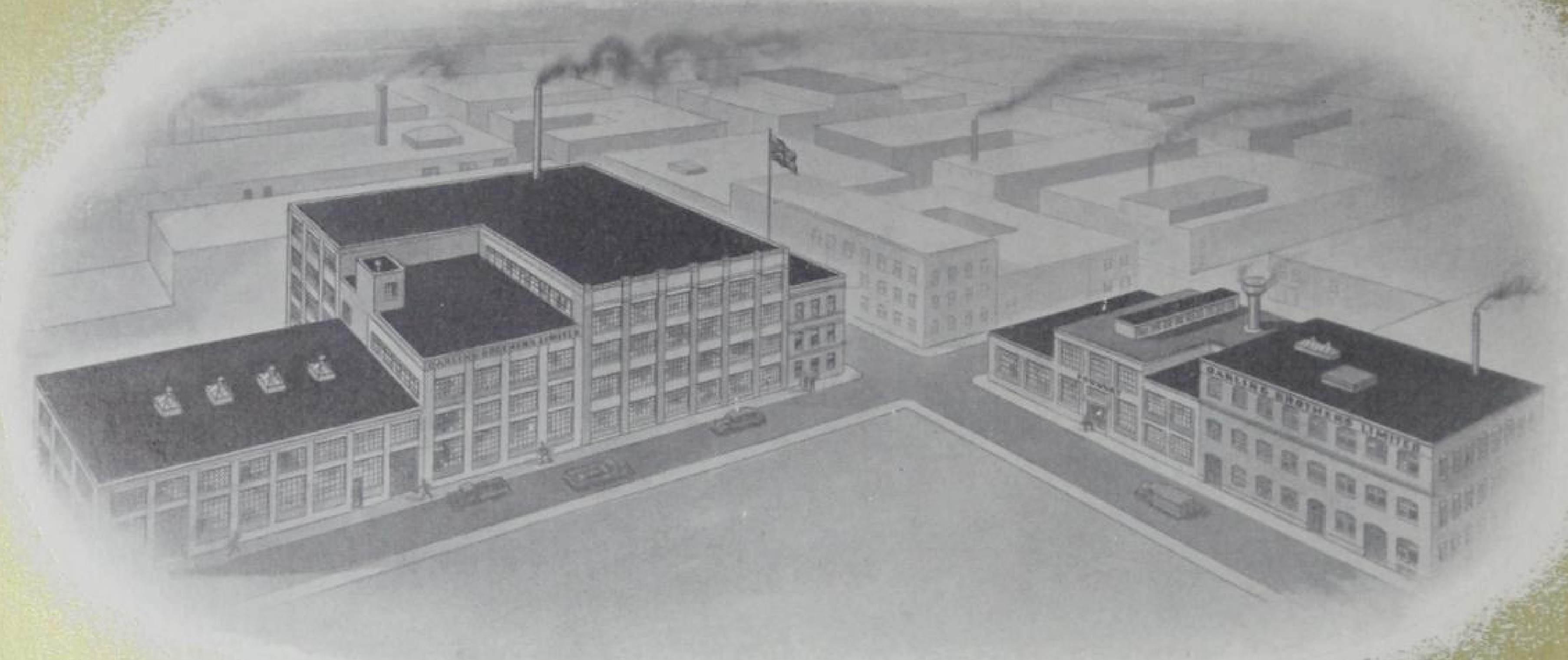
FRICTION LOSSES THROUGH PIPE FITTINGS IN TERMS OF EQUIVALENT LENGTHS OF STANDARD PIPE

Nominal Pipe Size, Inches	Actual Inside Diameter, Inches	Standard Elbow or on Run of Tee Reduced in Size ½	Long-Sweep Elbow or on Run of Standard Tee	45° Elbow	Tee Through Side Outlet	Gate Valve Full Open	Globe Valve Full Open	Check Valve (Approx.) varies with type & make	Angle Valve Full Open	Close Return Bend
¾	0.824	2.2	1.4	1.0	4.5	0.46	21.0	5.5	11.0	5.1
1	1.049	2.6	1.7	1.2	5.3	0.56	27.2	7.5	14.7	6.1
1¼	1.380	3.5	2.3	1.6	7.2	0.78	37.9	9.0	18.8	8.5
1½	1.610	4.1	2.7	1.9	8.9	0.90	45.2	10.5	21.0	10.1
2	2.067	5.2	3.5	2.5	11.0	1.15	55.6	13.5	29.0	13.0
2½	2.469	6.5	4.1	2.9	14.0	1.32	67.8	16.0	33.7	15.2
3	3.068	8.0	5.1	3.7	16.0	1.6	86.00	20.4	41.0	18.5
4	4.026	10.5	7.0	5.0	20.9	2.2	110.00	26.7	55.0	24.8
5	5.047	13.0	8.8	6.1	25.4	2.7	142.00	33.2	71.0	30.2
6	6.065	16.0	10.3	7.5	32.1	3.5	168.00	40.8	82.0	37.0
8	7.981	20.2	14.1	10.0	42.9	4.5	224.00	53.3	112.0	50.0
10	10.020	25.3	17.0	12.7	52.1	5.3	275.00	67.0	141.0	62.0
12	12.000	30.2	20.0	15.0	62.8	6.8	336.00	78.7	160.0	72.0

SUCTION HEAD REQUIREMENTS WHEN PUMPING HOT WATER

Suction Head Required for Centrifugal Pumps when Handling Hot Water at Different Altitudes.

Minimum Allowable Head in Ft. on Suction	TEMPERATURES OF WATER IN DEGREES F.									
	120	130	140	150	160	170	180	190	200	210
At sea level	....	....	....	....	0	+ 3	+ 5	+ 7	+10	+12
At 2,000 alt.	....	....	....	+ 1	+ 3	+ 5	+ 7	+10	+12	+15
At 4,000 alt.	....	0	+ 1	+ 3	+ 5	+ 7	+10	+12	+14	....
At 6,000 alt.	0	+ 1	+ 3	+ 5	+ 7	+10	+12	+14	+16	....
At 8,000 alt.	0	+ 3	+ 5	+ 7	+ 9	+12	+14	+16	....	....
At 10,000 alt.	+ 2	+ 4	+ 7	+ 9	+11	+14	+16	+18	....	....



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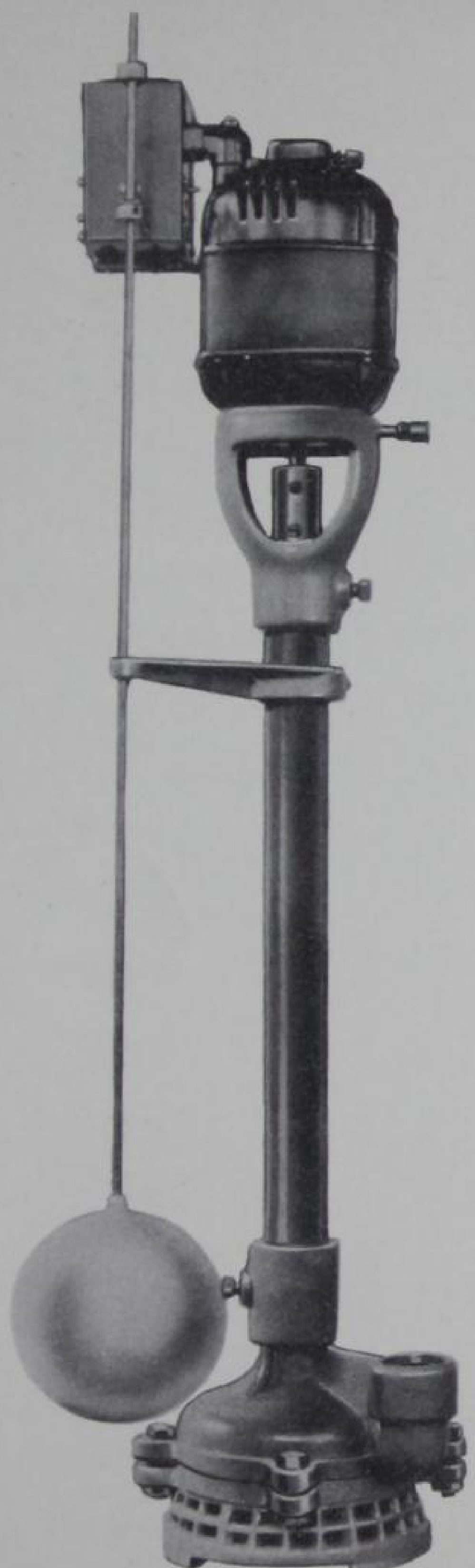
THE DARLING ELECTRIC CELLAR DRAINER

With our long experience of over thirty years in the design and manufacture of Vertical Centrifugal Pumps, we have produced a dependable electric motor driven Cellar Drainer. This unit is useful for draining boiler-rooms, tunnels, elevator pits, and is a very handy emergency unit for towns, manufacturing plants and institutions.



SPECIFICATIONS OF STANDARD UNIT

PUMP. The casing is of cast iron with large water passages to avoid clogging.

IMPELLER. Enclosed type, hydraulically and mechanically balanced.

SHAFT. Made of non-corrosive stainless steel.

BEARINGS. Self-lubricating pump bearing is supplied, also suitable ball thrust.

SUPPORT COLUMN. Made of 1½″ extra heavy steel pipe.

BASE AND SCREEN. Combined in one casting of cast iron, with circular base, providing rigid support for pump. The screen has exceptionally large water passages, and is many times the area of the suction.

MOTOR. ¼ H. P. repulsion induction motor, ball bearing type is furnished, direct connected to impeller shaft by flexible coupling. Complete current characteristics must be given when ordering. 110 volt single phase unit can be supplied from stock.

SWITCH. Heavy duty automatic float switch is mounted on the motor. Operated by seamless copper float.

COVER. Cast iron split cover easily adjusted vertically to suit depth of pit, can be supplied at extra cost, suitable for 18″ diam. pit or tile pipe basin. Outside diameter of cover is 20″.

THERMAL OVERLOAD PROTECTION. (Supplied at slight additional cost) is the enclosed circuit breaker type which can be reset by a push button.

ADAPTABILITY. Cellar Drainers are made standard for pits 24″ to 84″ deep, and require a minimum diameter of 15″, and are furnished at same price irrespective of which depth is required.

PERFORMANCE CHART

G. P. M. Capacity	Head in Feet		Motor H. P.
1750-1450 R.P.M.	1750 R.P.M.	1450 R.P.M.	1750-1450 R.P.M.
10	21	18	¼
20	19	17	¼
25	18	16	¼
30	17	15	¼
35	16	13	¼
40	14	12	¼
45	12	10	¼
50	10	6	¼

Electric Current Characteristics: single phase and poly phase 60 or 25 cycle.

Shipping Weights Less Cover.......... {2 Ft. Unit 100 Pounds. 3 Ft. Unit 110 Pounds. 4 Ft. Unit 120 Pounds.

Darling Brothers Limited

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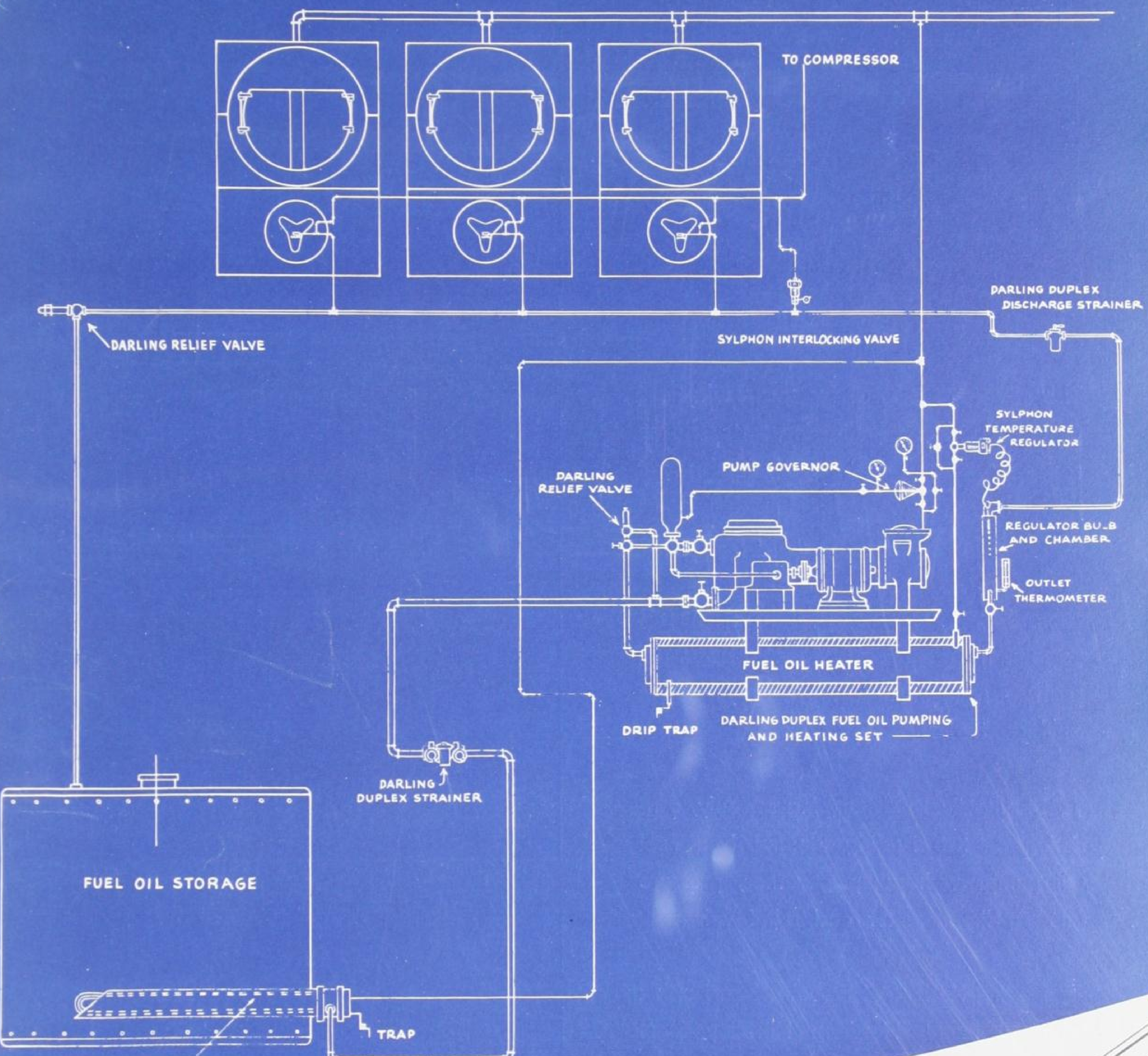
Cornwall — Calgary — Vancouver — St. John's, Nfld.



DARLING FUEL OIL BURNING EQUIPMENT

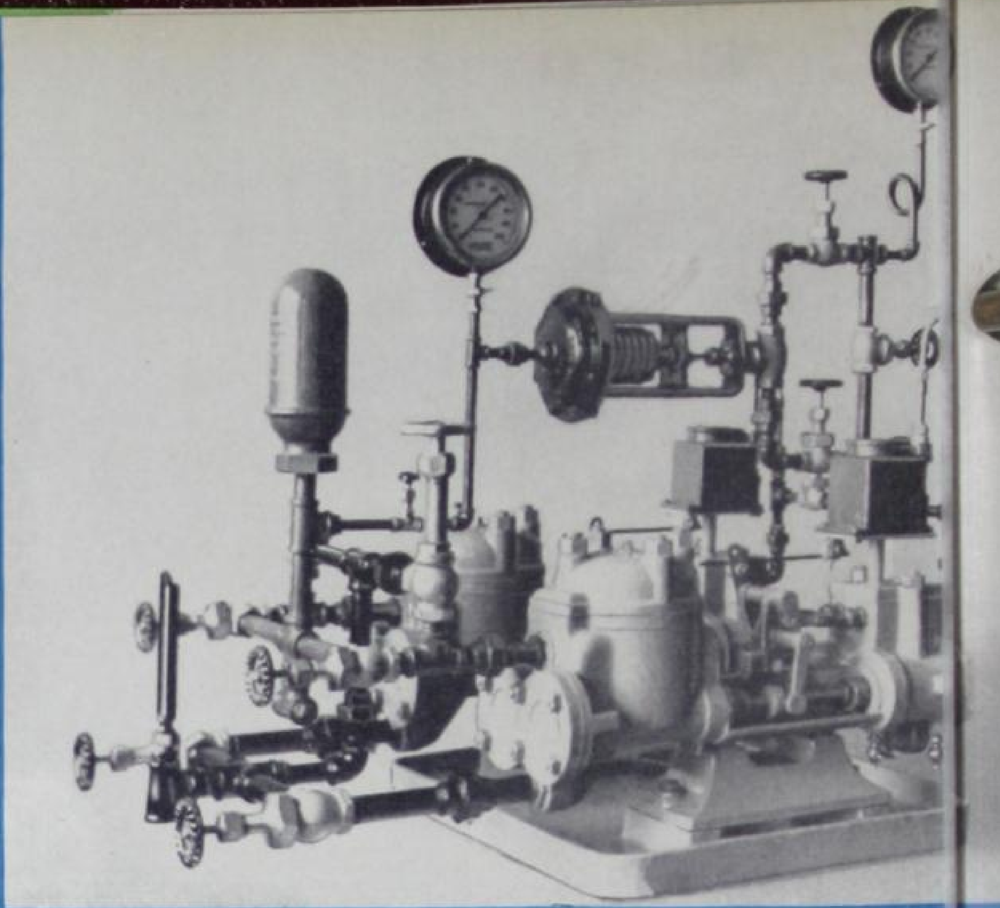
Types of pumping and heating equipment

The several types of Darling Twin Fuel Oil Pumping and Heating sets shown represent combinations of equipment that the customer has specified to meet the requirements of a particular fuel oil burning installation. These factors vary from job to job but consist mainly of modifications to pumping equipment, prime movers and controls.

1. Darling Fuel Oil Pumping set only, consisting of two Darling Steam-Driven Fuel Oil pumps with pump governor, pressure gauges, thermometer and relief valves.

2. Darling Horizontal Steam-Driven Duplex Fuel Oil Pump, Northern Nitralloy Steel Rotary Fuel Oil Pump with electric drive over three Whitlock-Darling Type "V" Fuel Oil Preheaters, factory assembled.

3. Darling Twin Fuel Oil Pumping and Heating set consisting of two Steam-Driven Fuel Oil pumps and two Whitlock-Darling Fuel Oil heaters with all accessories.



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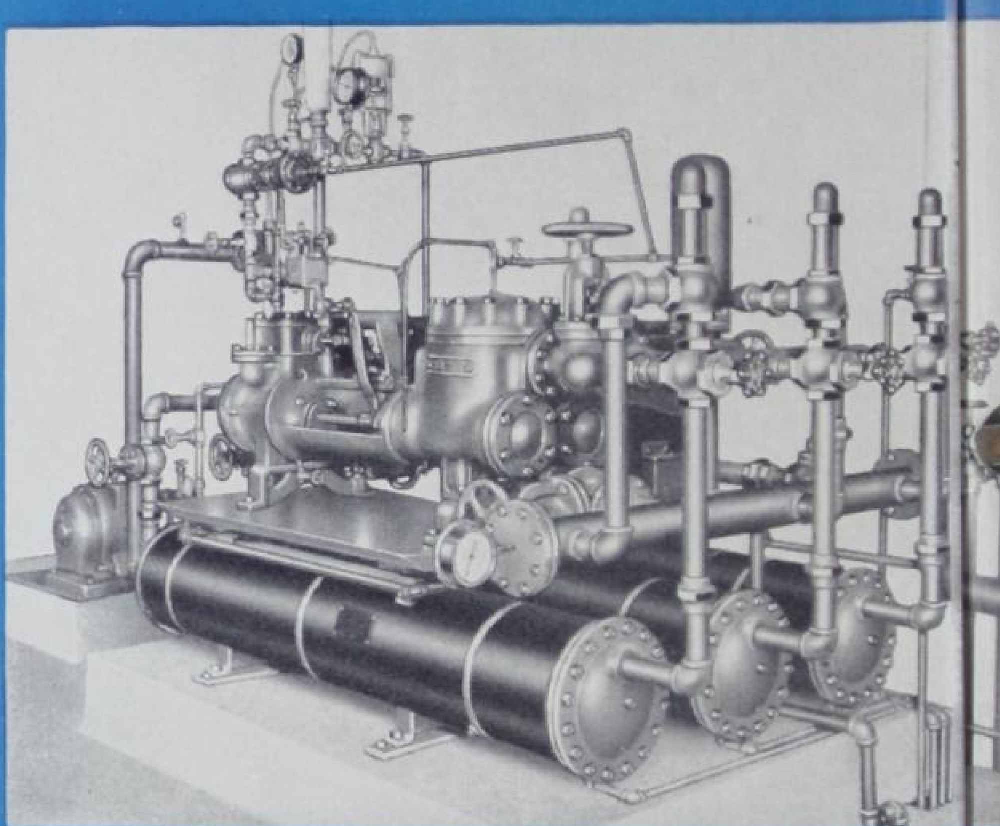

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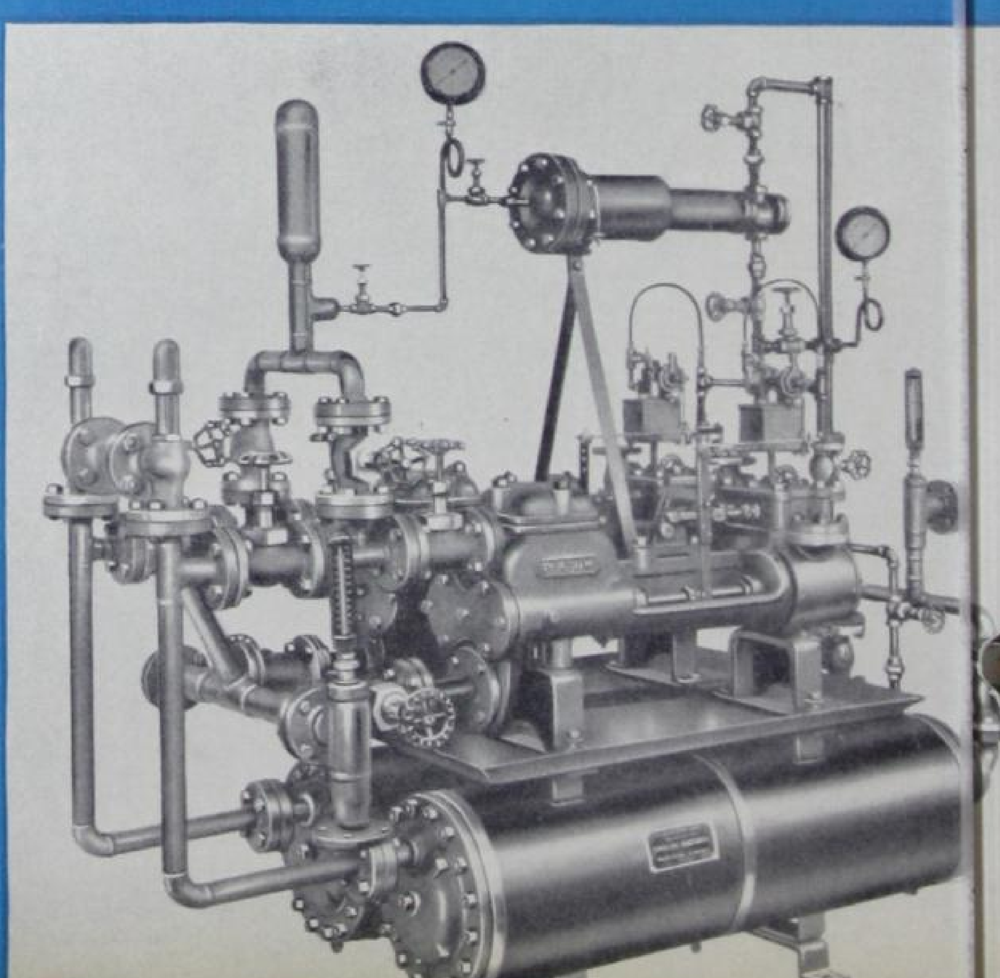

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pumping and heating set

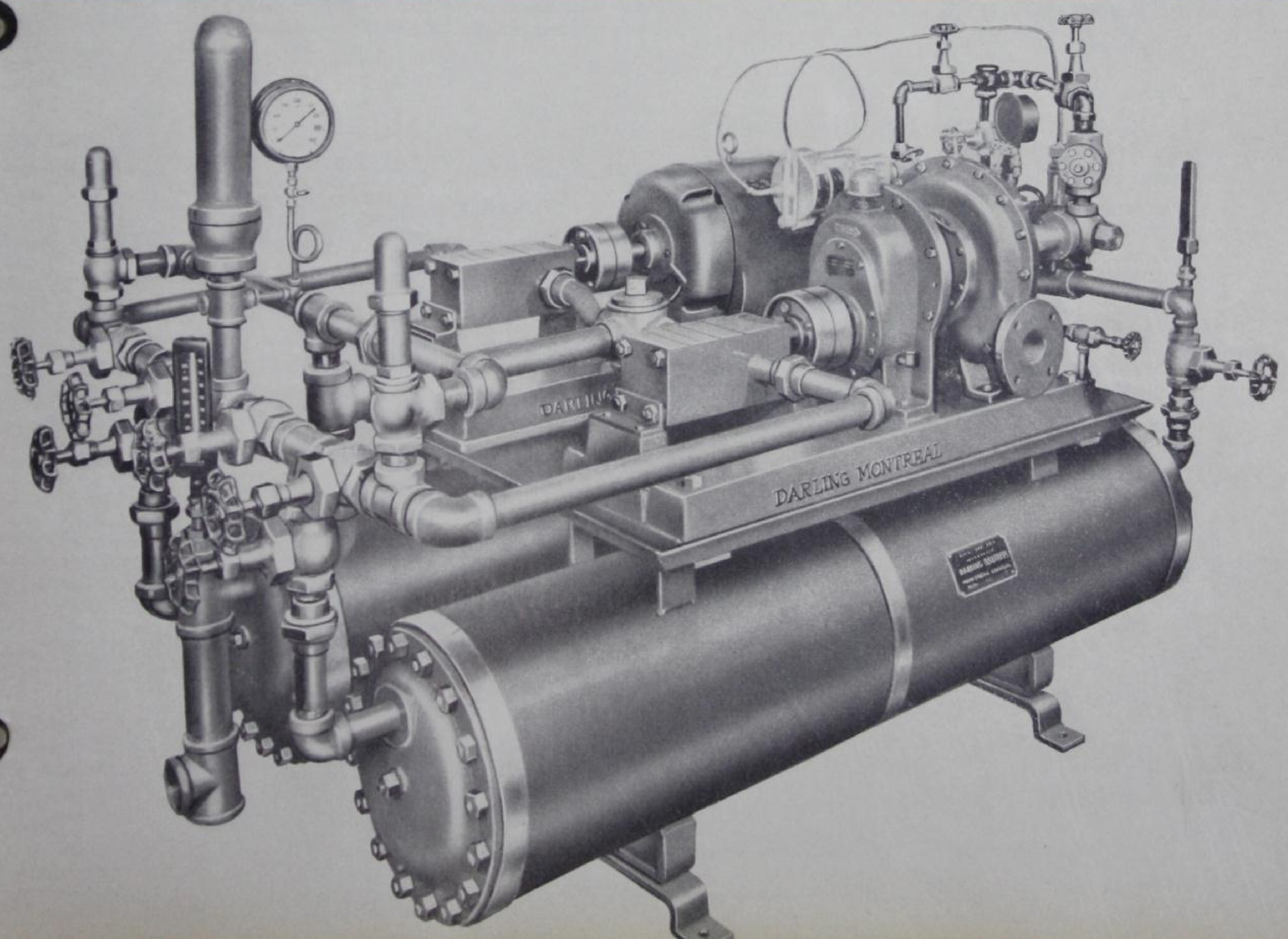
Darling factory-assembled Twin Fuel Oil Pumping and Heating sets help to solve many of the problems arising from the installation of Fuel Oil Burning Equipment. The units are correctly sized to handle with ease the specified capacities, temperature rise and oil pressures.

All piping, valves and fittings necessary to connect the components are carefully fitted by experienced mechanics to assure leak-proof piping systems. The pump and heaters are arranged to operate in any combination that will meet a given operating and load condition.

Accessory equipment includes Darling Oil Relief Valves, Sylphon Temperature Regulators and Pump Governors, Darling Duplex Suction and Discharge Strainers all of which may be assembled into one of these compact ready-to-operate units.

Installation costs can be reduced by the use of Darling Fuel Oil Pumping and Heating Sets, for they eliminate much of the difficult piping on the job site. Darling Pumping and Heating Sets are available in a wide range of capacities and oil pressures.

Photo below shows Combination Electric and Steam Turbine Driven Northern Rotary Fuel Oil Pumps and No. 16 Type "V" Whitlock-Darling Fuel Oil Preheater, comprising a Darling Fuel Oil Pumping and Heating Set supplied to Combustion Engineering Corp. Ltd., for installation at Dominion Bridge Co. Ltd., Lachine, Que.



the preheating of fuel oil

For most effective combustion, fuel oil must be properly atomized at the burner, and atomizing is best effected at one viscosity. Extensive experimentation has shown this viscosity to be 150 seconds Saybolt Universal; similarly 375 seconds Saybolt Furol has been found to give the most desirable pumping viscosity.

With heavier industrial fuel oils, therefore, preheating is necessary before admission to the burner. The temperature to which the oil must be preheated is primarily dependent upon two factors:

> First, the viscosity-temperature characteristics of the oil, and
>
> Second, the mechanical design of the burner nozzle.

The first point has been covered above, and for the second point we can say generally that the heat supplied by the heater, plus the heat supplied at the burner, should be sufficient to reduce the relative fluidity of the oil to approximately 150 seconds Saybolt Universal. Thus, steam atomizing and rotary cup burners can accept oils at a higher viscosity than the pressure atomizing burner, since they supply additional heat to the oil at the nozzle.

It is probably well to point out here that, contrary to a belief accepted by some, specific gravity is no index of the viscosity, or of the temperature to which oil should be preheated for proper atomizing. Oils of the same specific gravity may have vastly different viscosities at the same temperature, and the temperature to which one oil must be heated for the best atomizing may be entirely too low for another oil of the same specific gravity.

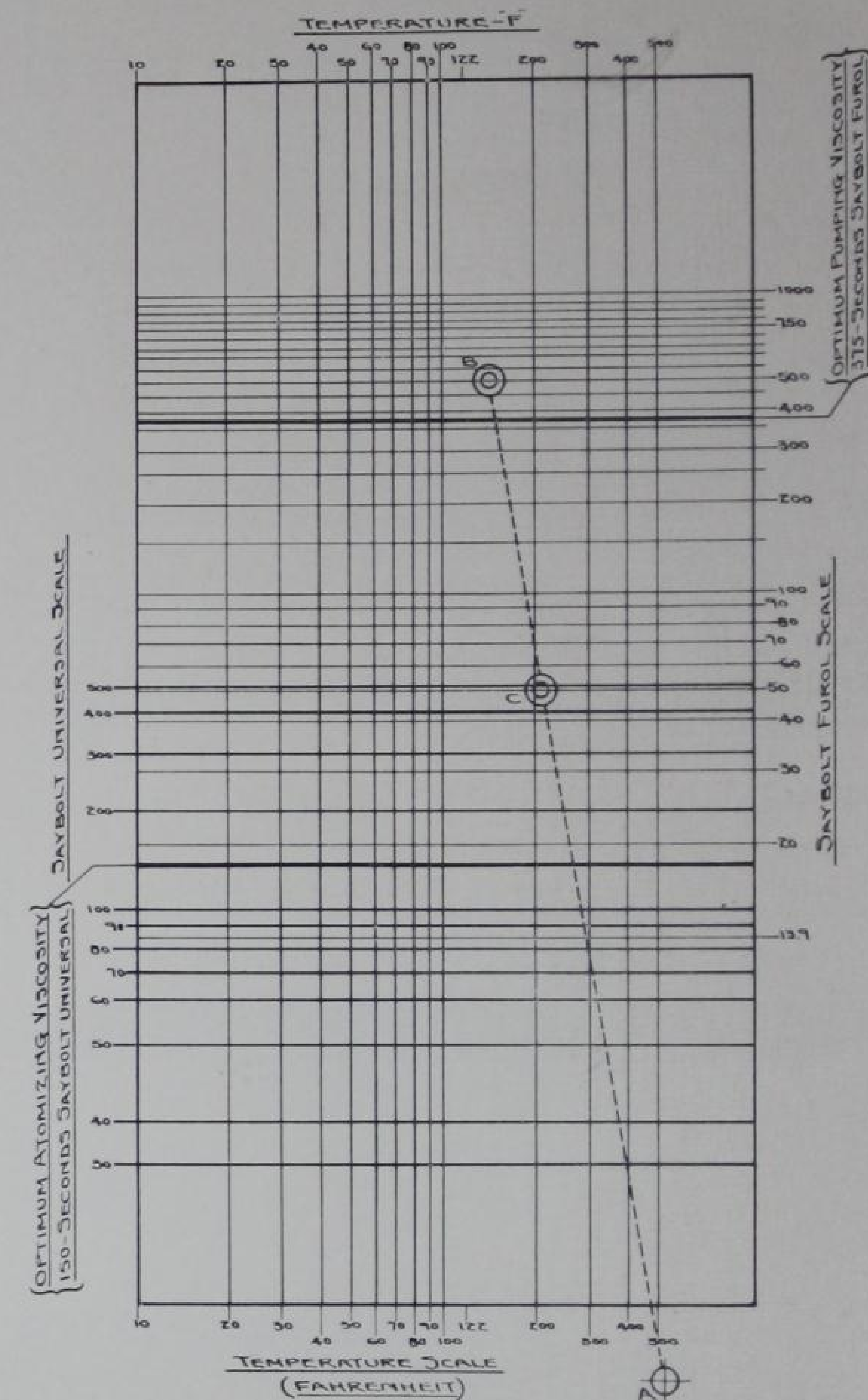


Chart courtesy of Simmons-Boardman Publishing Co.

Fig. 1 — Viscosity-Temperature Characteristics of Fuel Oils.

The Viscosity-temperature characteristics of fuel oils when plotted on a double logarithmic scale, result in straight lines with a common origin — shown above as Point A. Knowing the viscosity of an oil at any one temperature, we can plot this one point and join it with the common point A to obtain the complete viscosity-temperature characteristics.

Example to Show Use of Viscosity-Temperature Chart

KNOWN: Viscosity of Fuel Oil X — 500 seconds Saybolt Furol at 140°F.

WANTED: Temperature required to reduce viscosity to 50 seconds Saybolt Furol.

Plot Point B (500 SSF—140°F.) and join with Point A — intersection with 50 SSF line indicates temperature 210°F. at Point C.

For convenience we have drawn the 150 seconds Saybolt Universal line and the 375 seconds Saybolt Furol line for the optimum atomizing and pumping viscosities, respectively.

whitlock darling fuel oil heaters

(Upper Illustration)
Whitlock-Darling Type "V" all-steel straight tube Fuel Oil Preheater.

(Lower Illustration)
Whitlock-Darling Type "V" Fuel Oil Heater insulated with 2 inches of 85% magnesia, covered with planished steel, secured by brass bands.

EASY CLEANING:—Type V is of a straight tube, fixed sheet design which permits easy mechanical cleaning after merely removing the front and rear heads. The unit has a minimum of joints, with no bolted joints on the steam side. Type V is designed for oil and steam working pressures up to 300 psi. and steam temperatures up to 410°F.

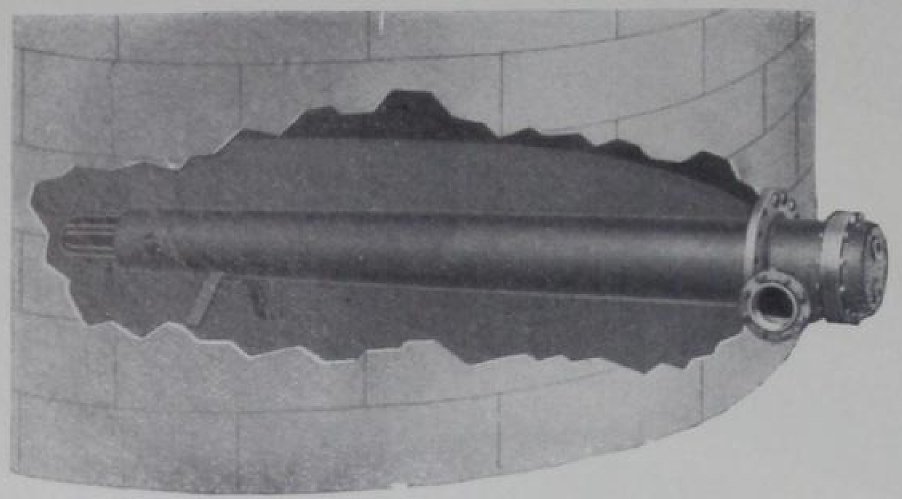
CONSTRUCTION:—Shells: Seamless steel pipe. **Tube Sheets:** Rolled steel welded to the shell ends. **Oil Distributing Heads:** Steel or cast iron. **Tubes:** ⅝" O.D. x 16 BWG seamless steel. **Support Brackets:** May be supplied if required.

TABLE I — HEATING CAPACITIES OF TYPE V FUEL OIL HEATERS
IN POUNDS PER HOUR OF BUNKER "C" FUEL OIL

Size or Heater No.	0 PSIG Steam	5 PSIG Steam		25 PSIG Steam			50 PSIG Steam				100 PSIG Steam			
	Temp. Range	Temp. Range		Temp. Range of Oil			Temperature Range of Oil				Temperature Range of Oil			
	90°-175°	90°-175°	90°-200°	90°-175°	90°-200°	90°-225°	90°-175°	90°-200°	90°-225°	90°-250°	90°-175°	90°-200°	90°-225°	90°-250°
3	180	260	160	430	290	190	640	440	320	220	930	660	500	380
4	230	320	200	540	360	240	800	550	400	280	1160	820	630	470
5	280	390	240	650	440	290	960	660	480	340	1400	980	750	570
6	380	515	303	850	570	385	1270	875	635	450	1850	1345	1000	750
7	465	650	380	1165	715	485	1590	1100	800	570	2320	1685	1250	940
8	560	780	465	1280	860	580	1900	1320	960	680	2790	2020	1500	1130
9	750	1030	600	1700	1150	775	2530	1750	1270	900	3710	2690	2000	1500
10	935	1290	755	2130	1430	970	3180	2200	1600	1130	4650	3370	2500	1880
11	1165	1610	940	2580	1780	1210	4000	2740	2000	1410	5800	4200	3100	2350
12	1400	1940	1130	3200	2140	1450	4750	3300	2400	1700	6950	5050	3700	2850
13	1870	2590	1510	4260	2850	1940	6350	4400	3200	2260	9300	6730	5000	3770
14	2330	3230	1890	5330	3570	2430	8000	5500	4000	2830	11600	8420	6200	4700
15	2800	3900	2270	6400	4300	2900	9500	6600	4800	3400	13950	10100	7450	5650
16	3700	5150	3030	8500	5700	3850	12700	8750	6350	4500	18500	13450	10000	7500
17	4650	6500	3800	11650	7150	4850	15900	11000	8000	5700	23200	16850	12500	9400
18	5600	7800	4500	12800	8600	5800	19000	13200	9600	6800	27400	20200	15000	11300
18½	6560	9100	5300	15000	10000	6800	22300	15400	11200	8000	32600	23600	17400	13200
19	7500	10300	6000	17000	11500	7750	25300	17500	12700	9000	37100	26900	20000	15000

Size or Heater No.	125 PSIG Steam				150 PSIG Steam				200 PSIG Steam			
	Temperature Range of Oil				Temperature Range of Oil				Temperature Range of Oil			
	90°-200°	90°-225°	90°-250°	90°-275°	90°-225°	90°-250°	90°-275°	90°-300°	90°-225°	90°-250°	90°-275°	90°-300°
3	720	540	410	320	670	510	360	280	820	640	510	360
4	900	670	510	400	840	640	460	360	1060	800	630	450
5	1080	810	620	480	1000	770	560	440	1240	960	760	540
6	1430	1075	820	630	1330	1030	700	550	1665	1300	1025	720
7	1800	1350	1030	800	1670	1280	870	680	2090	1625	1285	900
8	2150	1620	1240	960	2000	1550	1050	820	2500	1950	1550	1080
9	2870	2150	1640	1280	2670	2050	1400	1080	3330	2600	2050	1440
10	3450	2690	2050	1540	3350	2570	1680	1360	4180	3260	2570	1800
11	4500	3400	2570	2000	4160	3200	2180	1700	5200	4060	3200	2250
12	5370	4000	3100	2400	5000	3850	2620	2040	6250	4900	3850	2700
13	7150	5300	4100	3200	6700	5150	3500	2700	8350	6500	5150	3600
14	9000	6750	5150	4000	8350	6400	4370	3400	10400	8130	6400	4500
15	10750	8070	6200	4800	10000	7700	5250	4050	12500	9800	7750	5400
16	14300	10750	8200	6300	13300	10300	7000	5500	16650	13000	10250	7200
17	18000	13500	10300	8000	16700	12800	8700	6800	20400	16250	12850	9000
18	21500	16200	12400	9600	20000	15500	10500	8200	25000	19500	15500	10300
18½	25300	18900	14500	11200	23400	18000	12200	9500	29300	22800	18000	12600
19	28700	21500	16400	12800	26700	20500	14000	10800	33300	26000	20500	14400

whitlock-darling fuel oil preheater suction type



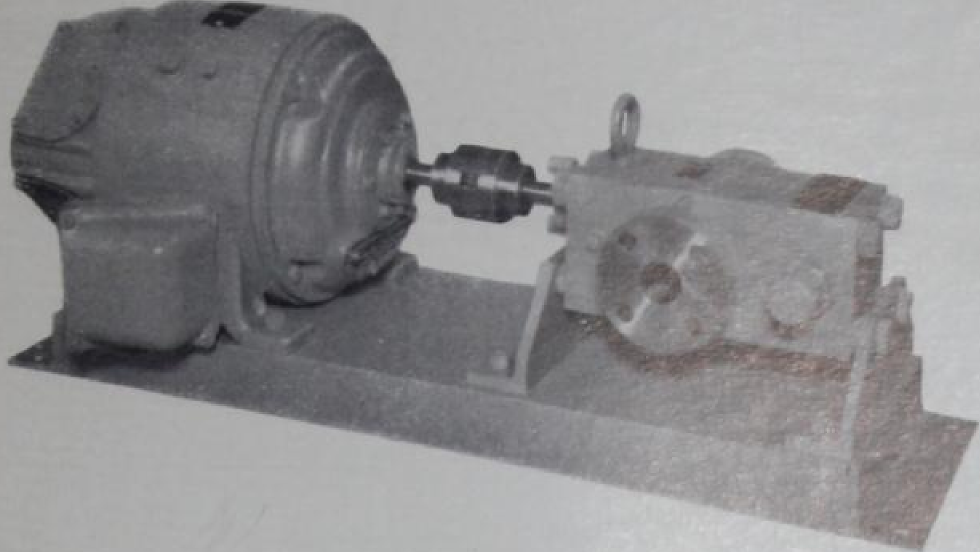
This heater can be used to heat any grade of oil up to a temperature at which it will flow readily to facilitate its withdrawal from large storage tanks. Since the oil is heated only as it is drawn off, it is not necessary to maintain the contents of the whole tank in a heated condition. This reduces radiation losses to a minimum. The entire heating element, with the exception of a few inches of the upper surface at the far end, is enclosed in a steel sheath through which the oil is drawn from the tank. The tubes are medium size seamless steel made up in the form of U-bends, with the ends expanded into a rolled steel tube sheet. The steam distributing chamber which directs steam through the tubes is of cast iron or cast steel depending on the steam pressure. The heater is furnished complete ready for welding, riveting, or bolting to the storage tank as may be required. The use of collar studs enables the head to be removed for inspection of the tubes without draining the storage tank. Capacities are based on heating Bunker C oil from 20°F. to 100°F. with steam at 100 psi. Tank dimensions should be given when requesting prices.

Preheaters for Vertical installation are made to suit individual requirements.

TABLE II — CAPACITIES and DIMENSIONS — WHITLOCK-DARLING HORIZONTAL SUCTION TYPE FUEL OIL PREHEATERS

Size No.	Capacity Lbs./Hr.	Diam. Head Flange	Approx. Overall Length	Minimum Diam. of Opening in Tank	Diam. of Plain Tank Attachment Flanges	Oil Connections	Steam Connections	Cond. Connections
3	580	10¼″	1′-11″	7″	13″	¾″	¾″	¾″
4	750	10¼″	2′-4″	7″	13″	¾″	¾″	¾″
5	910	10¼″	2′-9″	7″	13″	1″	¾″	¾″
6	1,200	10¼″	3′-6″	7″	13″	1″	¾″	¾″
7	1,500	10¼″	4′-4″	7″	13″	1″	¾″	¾″
8	1,800	10¼″	5′-1″	7″	13″	1½″	¾″	¾″
9	2,400	10¼″	6′-8″	7″	13″	1½″	¾″	¾″
10	3,000	13¼″	4′-4″	9″	16″	1½″	¾″	¾″
11	3,700	13¼″	5′-4″	9″	16″	2″	¾″	¾″
12	4,500	13¼″	6′-4″	9″	16″	2″	¾″	¾″
13	6,000	13¼″	7′-3″	9″	16″	2½″	¾″	¾″
14	7,500	16¼″	7′-11″	11″	19″	2½″	¾″	¾″
15	9,200	16¼″	9′-4″	11″	19″	3″	¾″	¾″
16	12,000	16¼″	12′-3″	11″	19″	3″	¾″	¾″
17	15,000	19¼″	8′-0″	14¼″	22″	4″	¾″	¾″
18	18,000	19¼″	9′-7″	14¼″	22″	4″	¾″	¾″
18½	21,000	19¼″	11′-1″	14¼″	22″	4″	¾″	¾″
19	24,000	19¼″	12′-6″	14¼″	22″	5″	1″	1″
19½	27,000	22¼″	10′-0″	16¼″	25″	5″	1″	1″
20	30,000	22¼″	12′-0″	16¼″	25″	5″	1¼″	1¼″
21	37,000	25¼″	9′-11″	20½″	28″	6″	1¼″	1¼″
22	45,000	25¼″	11′-9″	20½″	28″	6″	1¼″	1¼″
23	60,000	29¼″	11′-0″	24½″	32″	8″	1½″	1½″
24	75,000	29¼″	13′-6″	24½″	32″	8″	1½″	1½″

northern rotary fuel oil pump
series 4000



The Northern Series 4000 Rotary Fuel Oil Pump is fabricated of Nitralloy Steel and built to extreme fine limits of accuracy. It offers the known value of quick and convenient interchangeability of component parts. Available in a wide range of capacities and for pressures up to 300 lbs. Used as standard equipment on Darling Fuel Oil Pumping and Heating Sets. Pumps can be supplied with either electric or steam Turbine Drive.

Northern Rotary Gear Pumps Specifications for Handling Bunker "C" Fuel Oil

Viscosities of 1000 to 5000 SSU. Maximum suction lift 15" Hg.

TABLE III — CAPACITIES IN U.S. GPM AT 1150 RPM

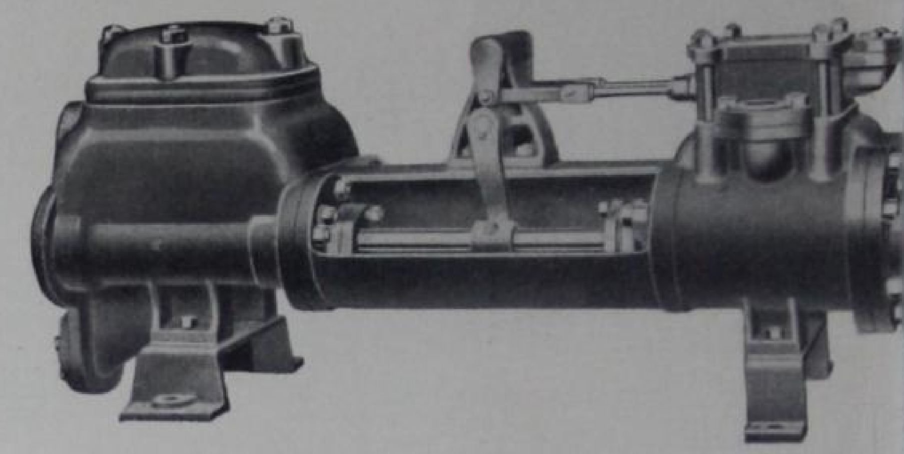
Discharge 100 PSI				Discharge 200 PSI				Discharge 300 PSI			
GPM	Pump Size	Pump Speed RPM	BHP	GPM	Pump Size	Pump Speed RPM	BHP	GPM	Pump Size	Pump Speed RPM	BHP
.39	4300-02	1150	.19	.37	4300-02	1150	.21	.35	4300-02	1150	.23
.77	4300-04	1150	.22	.74	4300-04	1150	.30	.71	4300-04	1150	.36
1.16	4300-06	1150	.28	1.12	4300-06	1150	.35	1.08	4300-06	1150	.43
1.55	4300-08	1150	.40	1.48	4300-08	1150	.5	1.42	4300-08	1150	.6
1.94	4400-05	1150	.47	1.86	4400-05	1150	.63	1.78	4400-05	1150	.74
2.9	4400-07	1150	.57	2.78	4400-07	1150	.75	2.66	4400-07	1150	.95
3.9	4400-10	1150	.65	3.73	4400-10	1150	.98	3.56	4400-10	1150	1.2
5.8	4400-15	1150	1.0	5.55	4400-15	1150	1.3	5.35	4400-15	1150	1.7
7.78	4400-20	1150	1.3	7.45	4400-20	1150	1.7	7.13	4400-20	1150	2.3
4.55	4500-07	1150	.85	4.36	4500-07	1150	1.2	4.17	4500-07	1150	1.4
6.07	4500-10	1150	1.0	5.81	4500-10	1150	1.35	5.58	4500-10	1150	1.8
9.1	4500-15	1150	1.4	8.74	4500-15	1150	1.9	8.35	4500-15	1150	2.5

TABLE IV — CAPACITIES IN U.S. GPM AT 850 RPM

Discharge 100 PSI				Discharge 200 PSI				Discharge 300 PSI			
GPM	Pump Size	Pump Speed RPM	BHP	GPM	Pump Size	Pump Speed RPM	BHP	GPM	Pump Size	Pump Speed RPM	BHP
7.47	4600-07	850	1.5	7.15	4600-07	850	2.0	6.85	4600-07	850	2.5
9.9	4600-10	850	2.0	9.5	4600-10	850	2.6	9.1	4600-10	850	3.2
15.2	4600-15	850	3.0	14.3	4600-15	850	3.9	13.6	4600-15	850	4.8
20.0	4600-20	850	4.0	19.2	4600-20	850	5.0	18.3	4600-20	850	6.3
24.8	4600-25	850	4.9	23.8	4600-25	850	6.3	22.8	4600-25	850	7.7
37.0	4700-30	850	6.5	35.5	4700-30	850	8.5	34.0	4700-30	850	10.7
49.5	4700-40	850	8.0	47.5	4700-40	850	11.0	45.5	4700-40	850	14.7
54.0	4800-30	850	9.0	51.8	4800-30	850	12.2	49.6	4800-30	850	15.4
72.0	4800-40	850	11.8	69.0	4800-40	850	16.0	66.0	4800-40	850	20.0
90.0	4800-50	850	15.0	86.0	4800-50	850	26.5				
108.0	4800-60	850	16.5								

darling steam pumps

The Darling Horizontal Duplex Steam-Driven Fuel Oil Pump has many features especially designed for pumping commercial grades of Fuel Oil.



These include snap ring plungers in the oil end and "Durabla" metal valves as standard fittings. Steel Liners and Stainless Steel Piston rods can be supplied if required.

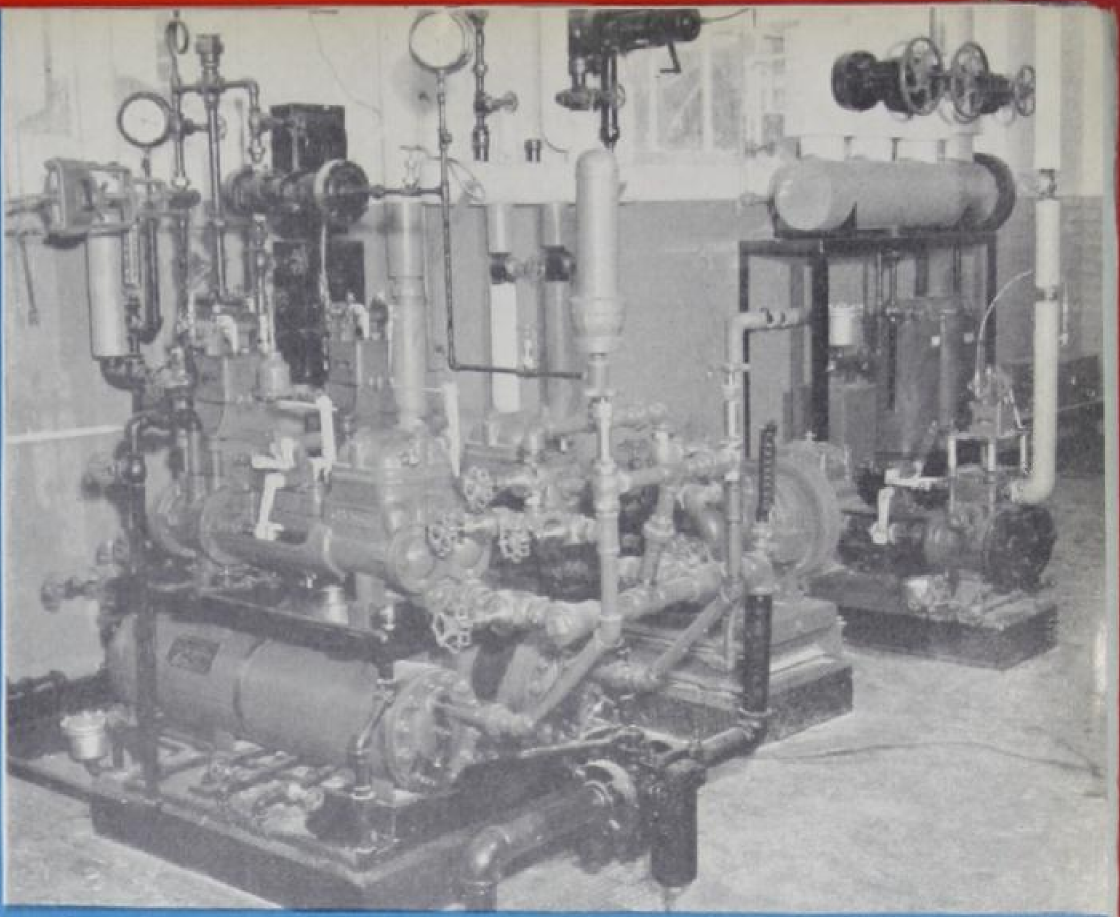
The attention to detail and the expert workmanship built into these pumps is proved by their wide acceptance in Fuel Oil applications. Available for oil pressures to 300 lbs. per square inch and steam pressures to 175 lbs.

TABLE V — CAPACITIES OF DARLING DUPLEX HORIZONTAL FUEL OIL PUMPS IN U.S. GPM

Size	U.S. Gallons per Stroke each Cylinder		At Single Strokes Each Side Per Minute													Size Pipe Connections				Floor Space		
			Fuel Oil			TANK SERVICE									Emergency							
			20	25	30	35	40	50	60	70	80	90	100	110	120	Steam	Exhaust	Suction	Discharge	Length	Width	Height
3 x2 x 3	.041	U.S.G. P.M.	1.64	2	2.46	2.87	3.28	4.1	4.9	5.7	6.5	7.4	8.2	9.02	9.8	* ⅜	* ½	*1¼	*1	26	9½	13
4½x2¾x 4	.103	U.S.G. P.M.	4.1	5.1	6.1	7.2	8.2	10.3	12.3	14.4	16.5	18.5	20.6	22.6	24.7	* ½	* ¾	*2	*1½	36	12½	17
5¼x3½x 5	.208	U.S.G. P.M.	8.3	10.4	12.5	14.5	16.6	20.8	24.9	29.1	33.2	37.4	41.6	45.7	5.0	*1	*1¼	*2½	*1½	43	16	17
6 x4 x 6	.326	U.S.G. P.M.	13	16.3	19.5	22.8	26	32.6	39.1	45.6	52.1	58.6	65	71.7	78.2	*1	*1½	*3	*2	46	16	22
7½x4½x 8	.551	U.S.G. P.M.	22	27.5	33	38.6	44	55.1	66.1	77.1	88.2	99.2	110.2	121.2	132.2	*1½	*2	†4	†3	63	23	29
7½x4½x10	.689	U.S.G. P.M.	27.5	34.4	41.3	48.2	55.1	68.9	82.6	96.4	110	124	138	151	165	*1½	*2	†4	†3	60	21	29
7½x5 x10	.850	U.S.G. P.M.	34	42.5	51	59.5	68	85	102	119	136	153	170	187	204	*1½	*2	†4	†3	62	21	29
10 x6 x10	1.224	U.S.G. P.M.	48.9	61	73	85	98	122	147	171	196	220	245	269	294	*2	*2½	†5	†4	66	26	32
12 x7 x12	2.	U.S.G. P.M.	80	100	120	140	160	200	240	280	320	360	400	440	480	*2½	*3	†6	†5	79	32	35

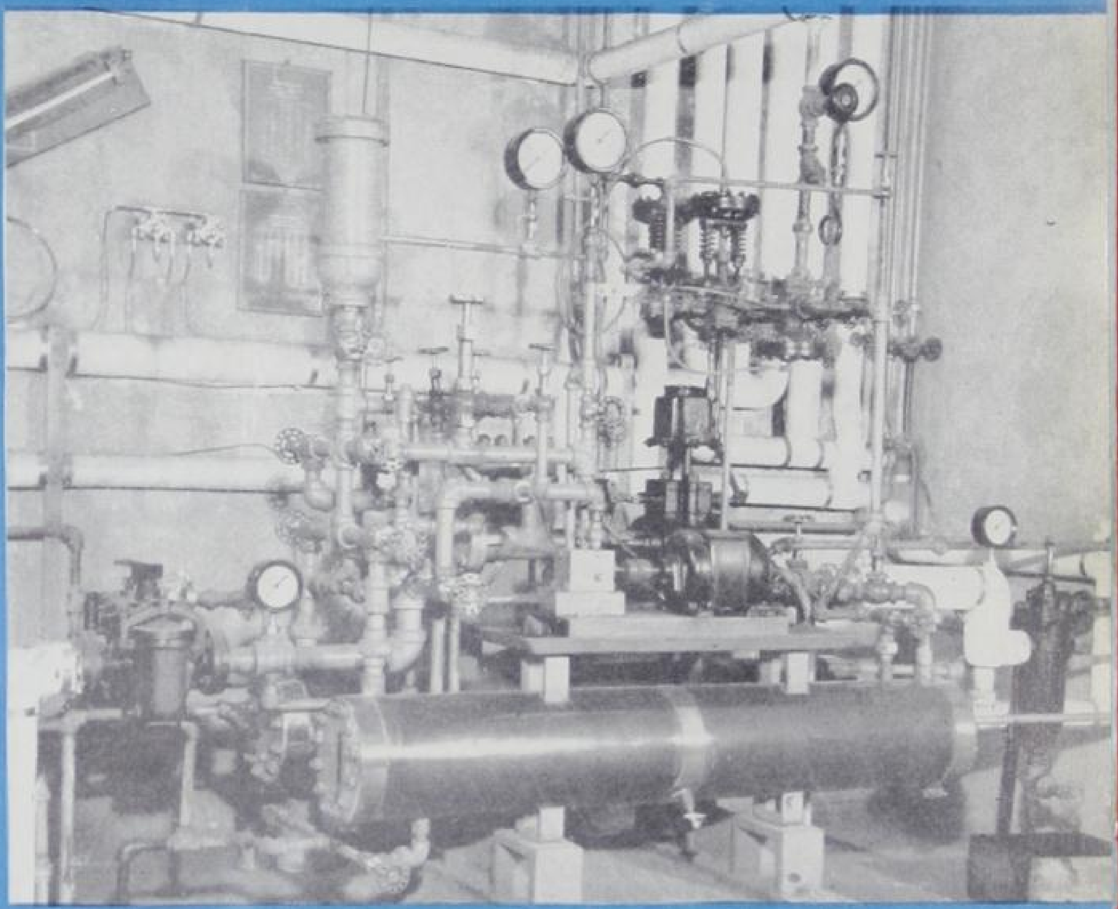
*Screwed Connection †Flanged Connectic

Installations of fuel oil pumping and heating sets



1

1. *National Cellulose of Canada Limited, Toronto, Ont.* — Unit consisting of two 4½″ x 2¾″ x 4″ Darling Horizontal Duplex Steam-Driven Fuel Oil Pumps over two Whitlock-Darling Type "V" Fuel Oil Preheaters. Accessories include No. 931 Sylphon Temperature Regulator, Fisher Pump Governor, Darling Oil Relief Valves and Duplex Suction Strainer.



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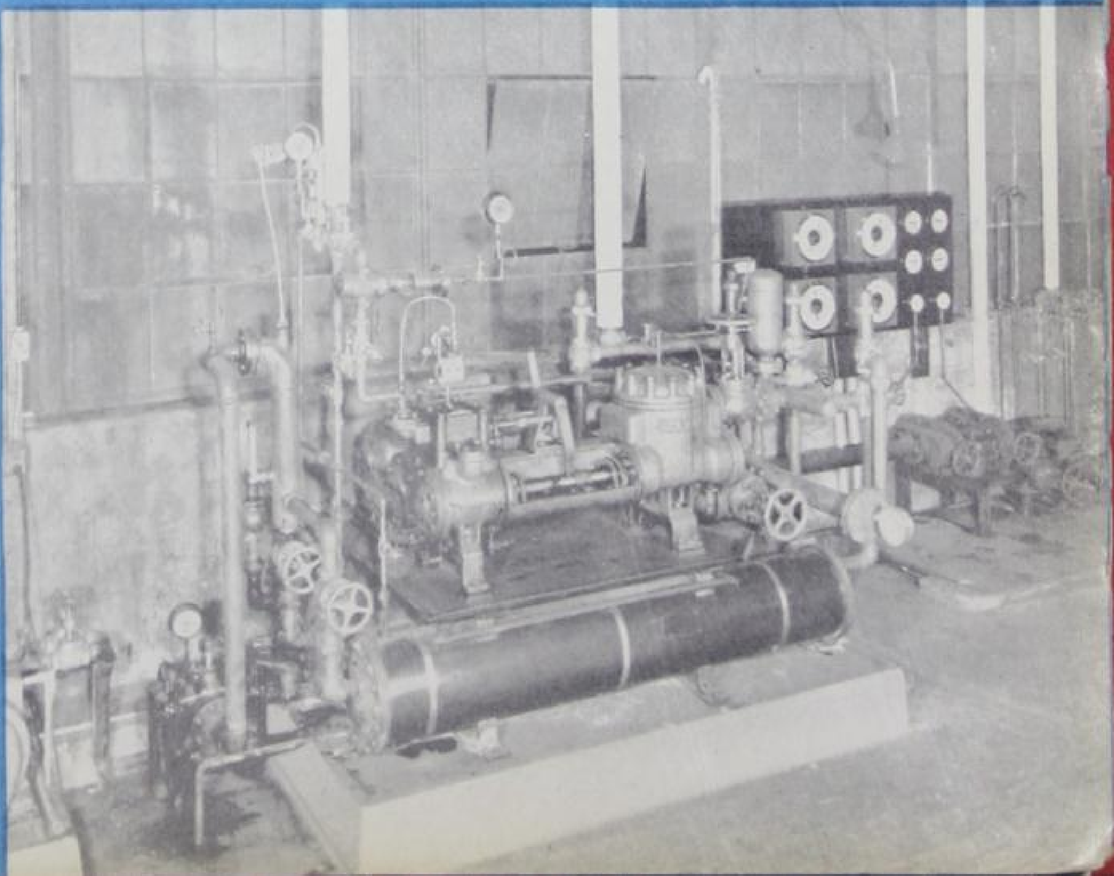
2. *St. Joseph's Hospital, Lachine, Que.* — Unit includes 3″ x 2″ x 3″ Darling Horizontal Fuel Oil Pump series 4000 electric-driven Northern Nitralloy Steel Rotary Fuel Oil Pump over two Whitlock-Darling special type Fuel Oil Preheaters. Accessory equipment includes Spence Temperature Regulator and Spence Governor, Darling Oil Relief Valves.



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3. *Montreal Locomotive Works, Montreal, Que.* — Unit consisting of one 7½″ x 4½″ x 8″ Darling Horizontal Duplex Steam Pump, one series 4000 electric-driven Northern Nitralloy Steel Rotary Fuel Oil Pump over three Whitlock-Darling Fuel Oil Heaters. Accessory equipment includes No. 931 Sylphon Temperature Regulator, Fisher Pumps Governor, Darling Oil Relief Valves, Darling Duplex Suction and Discharge Strainers.

darling bronze oil relief valves

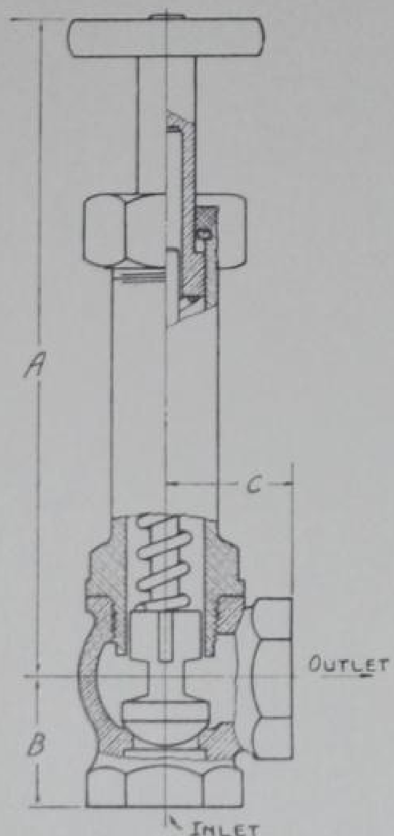


Fig. 2

Automatic regulating with ball seat design valve. There are no guides to block the po area and the spherical valve is self cleaning. Available in both the hand wheel adjustin or protected bonnet types. The latter for use where a permanent adjustment is required t maintain a fixed pressure release. The extra long spring assures smooth pressure regulatio free from chattering. Springs are readily interchangeable to provide a wide range of pressur adjustment.

TABLE VI

Size	A	B	C
3/4″	8 3/16	1 3/4	1 3/4
1″	8 3/16	1 3/4	1 3/4
1 1/4″	9 3/8	2 3/16	2 3/16
1 1/2″	9 3/8	2 3/16	2 3/16
*2″	12	3 1/8	3 1/8
*2 1/2″	12	3 1/8	3 1/8

*Bonnet Type Only

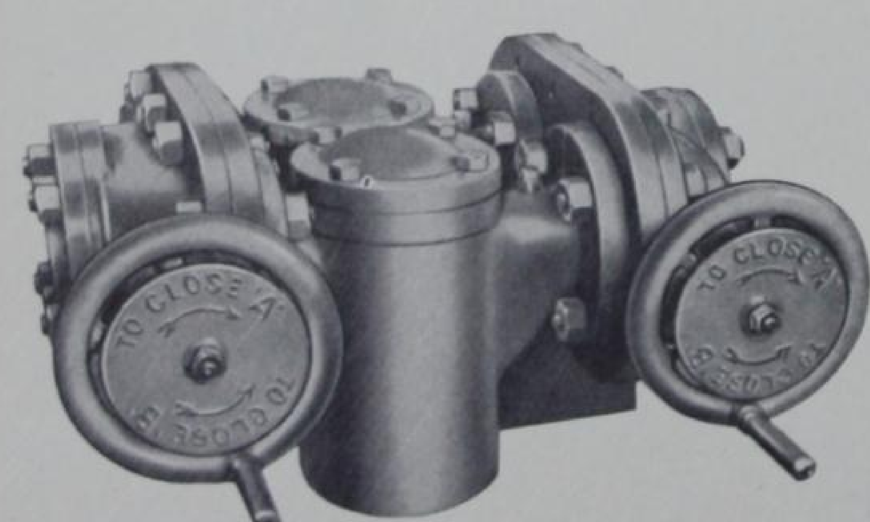
All dimensions in inches.

HAND WHEEL ADJUSTMENT

BONNET TYPE

darling duplex suction strainers

type "W"



Of rugged design, it is a dependable unit and often used i suction lines from oil tanks and other special application

Made in sizes from 4″ to 8″.

Companion flanges included as part of the unit.

Maximum working pressure 15 lbs. per sq. in.

The duplex suction strainer shows to greatest advantage where continuous operation is required; it is possible to shut off one strainer and use the other, permitting the first one to be cleaned and made ready in a few moments for future use.

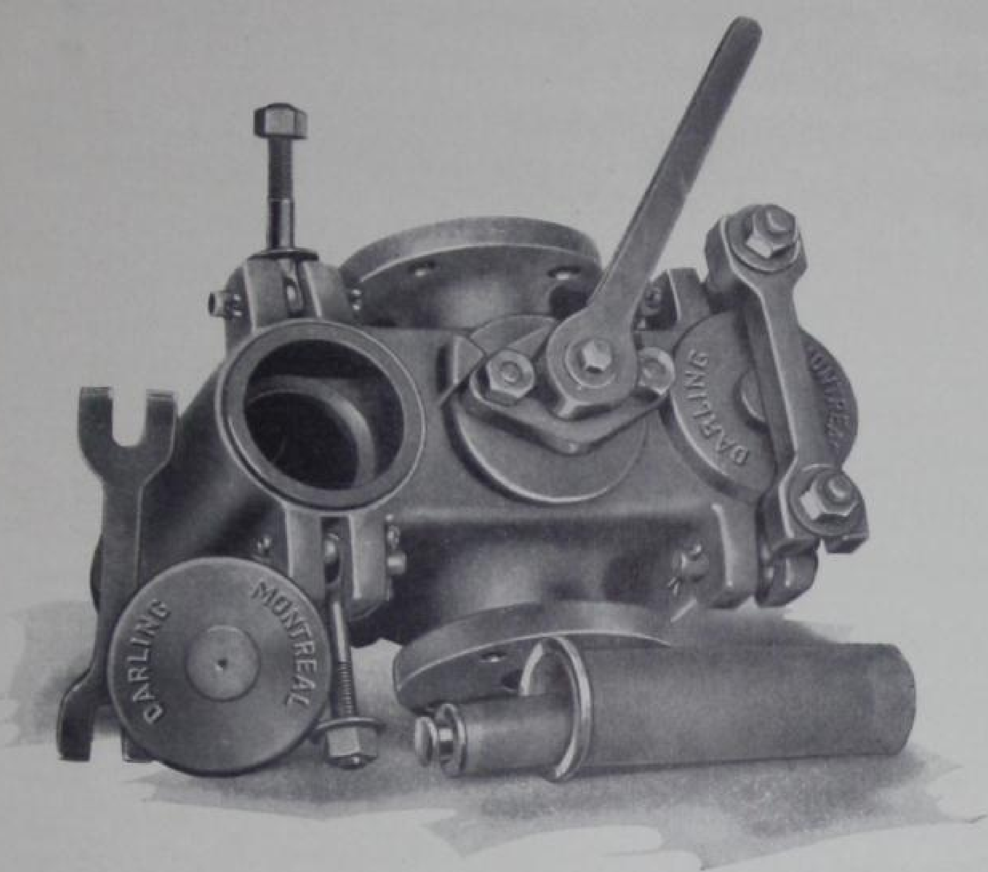
TABLE VII — DIMENSIONS OF DARLING DUPLEX STRAINER

Size	Face to Face	Overall Width	Overall Height	Extra space for strainer removal	Weight lbs.
4	24	28	16 5/8	14 5/8	600
5	28 1/8	32 1/4	19 7/8	14 1/4	790
6	30	34	21 1/2	15 1/4	950

All dimensions in inches.

darling duplex discharge strainers

type "D"



This cast iron duplex strainer has a wide application in many industries, but is particularly suited to Fuel Oil Burning installations.

The principal advantages of Darling Type "D" Duplex Strainers are as follows:

No valves — a 90-degree turn of the handle changes from one basket to the other.

Positive adjustment of tapered plug valve by means of jack screw.

Strainer basket being in two parts is more readily cleaned.

TABLE VIII

Size	A	B	C	D
1½″	8¾″	12″	7½″	10″
2″	10⅜″	16″	8″	12″
2½″	12″	18″	10″	13½″
3″	13″	19″	12″	17″

Double basket (the combined area of whose perforations is from six to ten times the cross sectional area of the pipe and about twice the area of other makes of strainers).

Designed so that when well cover is removed, level of liquid in well is lowered, exposing top of basket for removal. Connection provided at base for draining oil if required.

Handle partially covers basket-well which is in use, leaving exposed the well which is out of commission and free to be cleaned. In no position of handle is it possible to stop the flow. Maximum working pressure 100 lbs. Also available in cast bronze or cast steel for higher pressures if required.

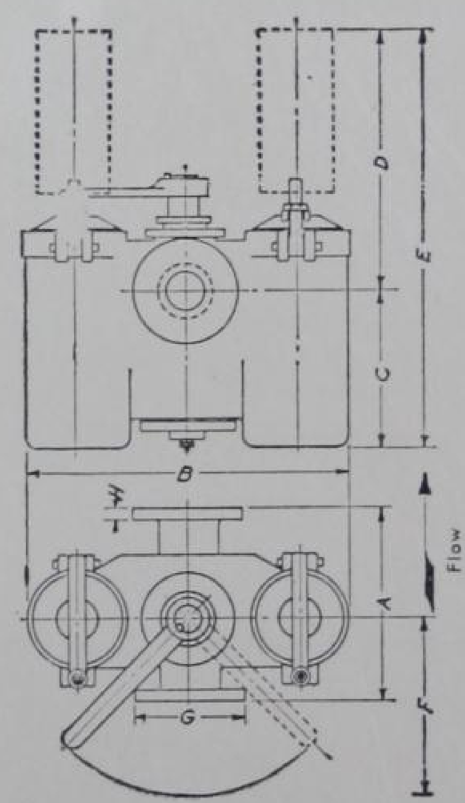


Fig. 3

whitlock-darling special type "V" fuel oil heater

Type "V" Fuel Oil Heater unit extension type head. This type of head has vertical oil connections thus eliminating the necessity of disconnecting piping when cleaning tubes. Available with top bracket if required.

BRANCH OFFICES AND REPRESENTATIVES

HALIFAX, N.S.
E. S. Stephenson & Co. Ltd. .... 155 Granville Street

SAINT JOHN, N.B.
E. S. Stephenson & Co. Ltd. .... 15 Dock Street

QUEBEC, P.Q.
W. J. Banks .... 140 St. John Street

ARVIDA, P.Q.
René Beaudet & Cie Ltée .... 122 High Street

TIMMINS, ONT.
Patricia Engineering Ltd. .... 168 Third Ave.

OTTAWA, ONT.
Darling Bros. Ltd. .... 18 Rideau Street

TORONTO, ONT.
Darling Bros. Ltd. .... 137 Wellington St. W.

WINNIPEG, MAN.
Darling Bros. Ltd. .... 123 Princess Street

CALGARY, ALTA.
H. F. Clarke & Co. Ltd. .... 1114 Fifth St. W.

VANCOUVER, B.C.
Frank Darling & Co. Ltd. .... 1144 Homer Street

ST. JOHN'S, NFLD.
Clayton Construction Co. Ltd. .... 198 Water Street

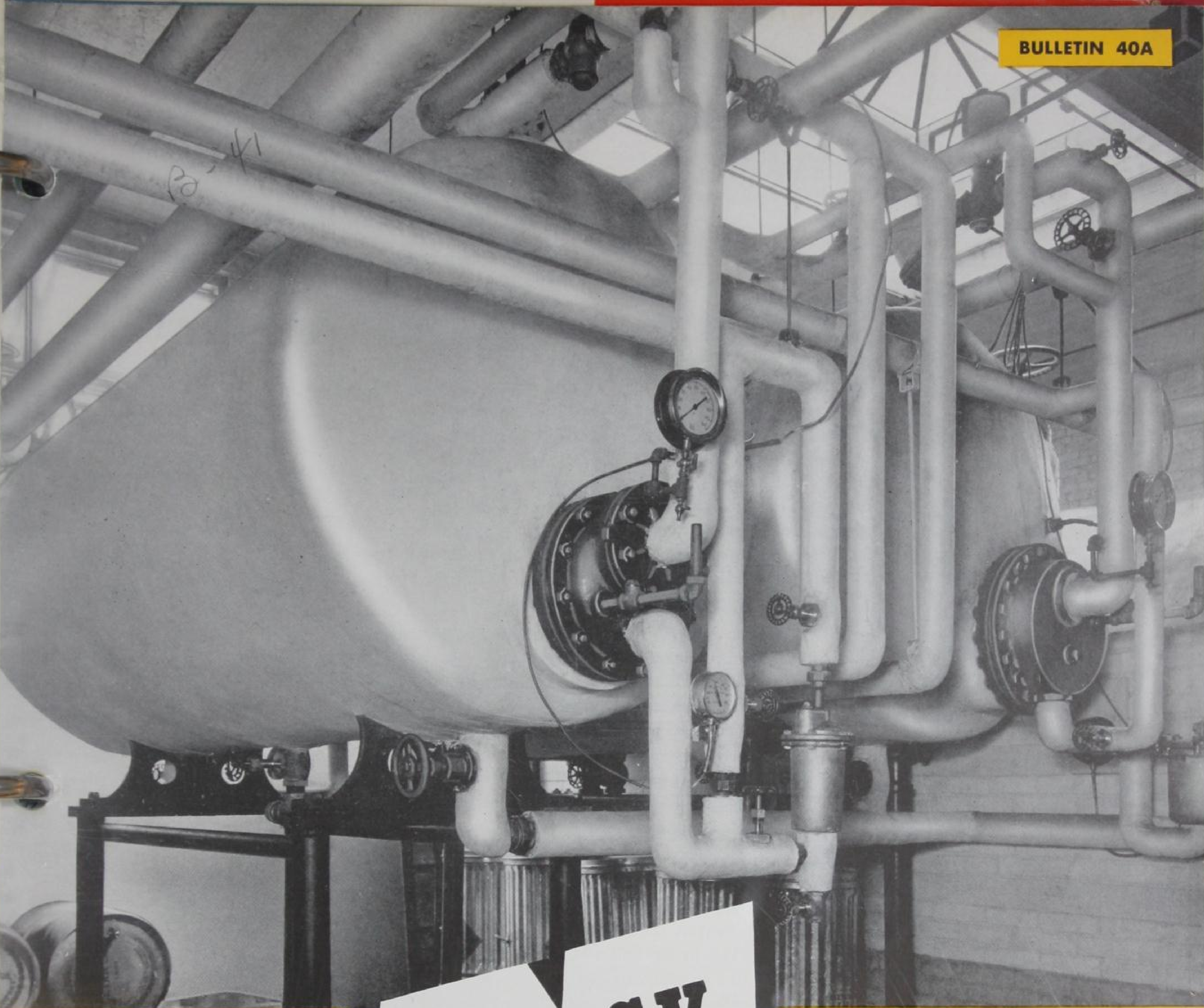
HEAD OFFICE AND WORKS

DARLING BROTHERS LIMITED

140 PRINCE ST. MONTREAL, CANADA

SINCE 1888

BULLETIN 40A



WHITLOCK TYPE K STORAGE HEATERS

1952

FOR HOSPITALS • LAUNDRIES • TEXTILE MILLS • FINISHING PLANTS • HOTELS • APARTMENT HOUSES • SCHOOLS • COLLEGES • PROCESS AND GENERAL INDUSTRIAL PLANTS

THE WHITLOCK MANUFACTURING CO., HARTFORD 10, CONNECTICUT

Advantages OF WHITLOCK TYPE K STORAGE HEATERS

The Whitlock Type K Storage Heater needs no introduction to our many friends throughout the country. The advantages of the storage type of heater for varying hot water demand rates is well known. This bulletin has been written for the convenience of architects, engineers and purchasers to facilitate their selection of Whitlock Type K Storage Heaters for conditions normally found in buildings of various classifications.

Where the demand for hot water is intermittent, and/or where the steam or heating medium supply is intermittent, the storage heater is preferable to an instantaneous heater. For example, consider a typical case where the hot water demand rate at 180°F. is as follows during a one hour period:

First 40 minutes — No hot water drawn.
Last 20 minutes — 1000 gallons of hot water withdrawn.

Since the 1000 gallons was drawn in 20 minutes, the actual average flow rate is 50 G.P.M. or 3000 G.P.H. An instantaneous heater to handle this requirement would have to be designed to heat at the rate of 3000 G.P.H. and would require steam at the rate of 105 boiler H.P. The Whitlock Type K Storage Heater, with a storage capacity in excess of 1000 gallons, will heat this 1000 gallons over a period of one hour and will use steam at the rate of 35 boiler H.P.

A Whitlock Type K Storage Heater, properly sized for the requirements, will absorb heat from any available quantity of exhaust steam or condensate, even at non-uniform flow rates, and deliver hot water at the desired temperature, also at irregular demand rates. If the quantity of exhaust steam or hot condensate is insufficient to produce enough hot water, additional live steam may be supplied through a separate heating element provided for this purpose when required.

CLASSES OF CONSTRUCTION

The Whitlock Type K Storage Heater is flexible in design to facilitate its selection for individual requirements.

HORIZONTAL HEATERS

This is the preferred position and the heater is furnished and equipped accordingly unless otherwise specified. The heating element is installed close to the bottom of the shell to take maximum advantage of hot water storage. Bronze tube supports are furnished when the length of tube bundle indicates their use, and these, in turn, are secured to the shell. The entire bundle is removable for inspection. Heaters are furnished with supporting cradles drilled for anchor bolts.

VERTICAL HEATERS

When space is limited, this may be the preferred method of installation, and when so ordered will be furnished and equipped accordingly. Vertical heaters are supported by three removable pipe legs complete with floor flanges or when indicated by purchaser the heater may be supported from the floor by means of structural steel supports. Unless otherwise specified, the distance from bottom of heater to floor level will be 12".

COMBINATION HEATERS

When heat is supplied from several sources, it is desirable to use a separate heating element for each source of supply. For example, if a part of the heating is to be done with exhaust steam and the balance with live steam, the exhaust steam heating element should be located low in the shell to get the maximum use from the exhaust steam. A separate heating element for live steam should be used and installed above the exhaust steam element, either in the same end or at the opposite end. Likewise, if part of the heating is to be done with hot condensate, or condensate flash from a receiver, the heating element should be located low in the shell, or, if more convenient, in a separate shell entirely. While the accompanying photograph indicates two separate heating elements—one for the primary heat source and the other for the live steam—the combination heater can be furnished with a single heating element, properly partitioned, to accept both heating sources — each at a different pressure. The combination heater can be furnished for vertical or horizontal installation.

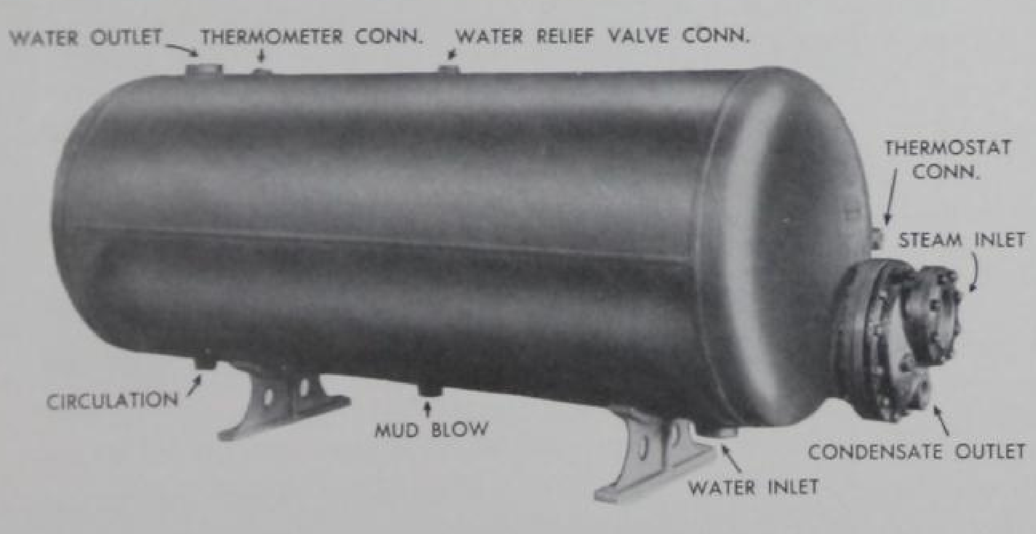


Fig. 1. Type K Storage Heater, Horizontal Design

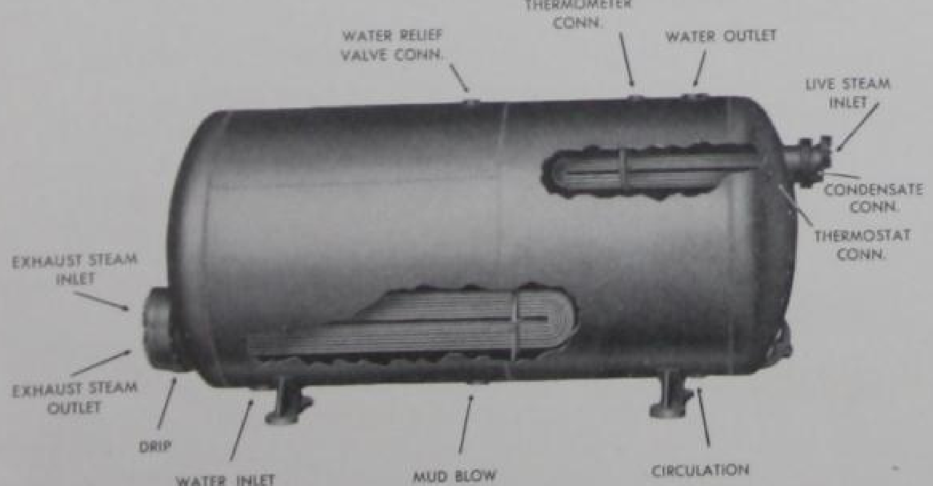


Fig. 2. Type K Storage Heater, Combination Design

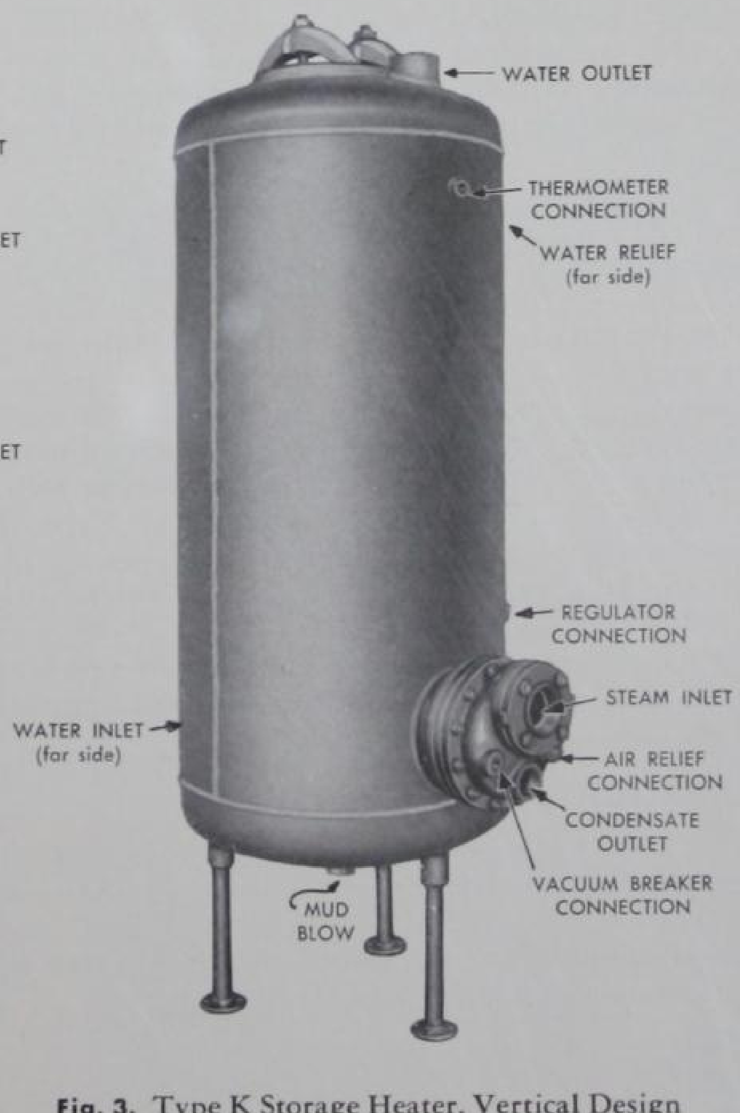


Fig. 3. Type K Storage Heater, Vertical Design

MATERIALS OF CONSTRUCTION

The shells and heads of Whitlock Type K Storage Heaters may be constructed of carbon steel, stainless steel, Everdur, copper, nickel, or of any other material which can be formed and welded, including also stainless steel-clad steel or nickel-clad steel, etc. The choice of materials depends upon the local water conditions, purity of hot water desired, and, of course, the economic considerations.

STANDARD STEEL SHELL HEATERS

It is well known that steel in contact with water is generally subject to corrosion. This is particularly true of steel in contact with water which is being heated, because the oxygen released as the water temperature is raised attacks the steel, producing iron oxide or rust. As a general rule, however, the rate of corrosion, rusting or pitting is slow — so slow, in fact, that many Whitlock Type K Storage Heaters with steel shells which were installed over a quarter of a century ago are still in satisfactory every day service. Corrosion or pitting is quite independent of the grade or class of steel used, and the rate of corrosion or pitting is much more rapid in some localities than in others. It is good practice, therefore, to add a corrosion allowance of 1/16″ to 1/8″ to the thicknesses shown in the tables on Pages 8 and 9.

NOTE: It is not necessary and is actually more expensive to specify a higher design pressure than conditions warrant instead of specifying a corrosion allowance. For example, in specifying an A.S.M.E. 60″ x 168″ Type K Storage Heater for 100# design pressure, the minimum thickness required for 100# design pressure is 3/8″ shell and 7/16″ heads. If a heavier shell is preferred, say, 5/8″ x 3/4″ (to insure longer life against corrosion) it will be noted that this heavier thickness appears under the heading of 175# design pressure. However, if the design pressure is specified as 175#, it is necessary to design the bolted joints and all other parts for the full working pressure of 175#, which results in an unnecessary expense. The specifications should read as follows:

> "Furnish 1 — Whitlock 60″ x 168″ Type K Storage Heater designed for 100# per sq. in. working pressure, shell to be 5/8″ thick with 3/4″ thick heads".

The low cost of Whitlock Type K Storage Heaters with steel shells favors their use in buildings where slow corrosion is tolerable.

EVERDUR SHELL HEATERS

The Whitlock-Everdur Type K Storage Heater is standard equipment for installations where the water is known to be actively corrosive to steel and in installations where it is imperative that the hot water be not contaminated with iron oxide.

Everdur is a silicon bronze with a corrosion resistance comparable with copper and having a tensile strength comparable with that of steel. Whitlock-Everdur Heaters are equipped with non-ferrous tube sheets, tubes and manhole covers so that the water passing through the shell comes in contact with nothing but non-ferrous metals.

ETERNO (COPPER-LINED) HEATERS

Whitlock-Eterno Heaters have a flange quality steel shell lined with electrolytic sheet copper. The steel shell is sufficiently heavy to accommodate the full working water pressure, while the sheet copper is of a thickness ample to prevent corrosion.

Extreme care is taken in the forming, fitting, and joining of the copper sheet to assure tightness and to assure protection of the steel shell.

Small tapped openings are made through Everdur spuds welded to both the steel shell and to the copper inner shell. Larger connections are made through a sleeve of copper which is rolled back over the outer shell flange.

ALLOY SHELL HEATERS

Where conditions demand their application, stainless steel, nickel, monel and stainless steel-clad or nickel-clad shells can and have been furnished. Your local Whitlock representative will be glad to examine your individual requirements and offer recommendations.

NON-METALLIC COATED STEEL SHELL HEATERS

The application of non-metallic coatings—enamels, plastics, cement, etc. to the interior surface of a steel shell — provide low cost protection against shell corrosion. Whitlock Manufacturing Standards cover detailed procedure and steps for the effective application of approved coatings. Recommendations are available upon request.

SPECIFICATIONS

Both shell and heating elements of Whitlock Type K Storage Heaters are hydrostatically tested to pressures required by the customer, state regulations or special codes. In lieu of an indicated test requirement, Whitlock Manufacturing Standards require that the heater be tested at a pressure not less than 150% of the specified working water pressure.

Construction is available according to Whitlock Manufacturing Standards, A.S.M.E. Code for Unfired Pressure Vessels, and other special codes.

WHITLOCK INSTALLATIONS

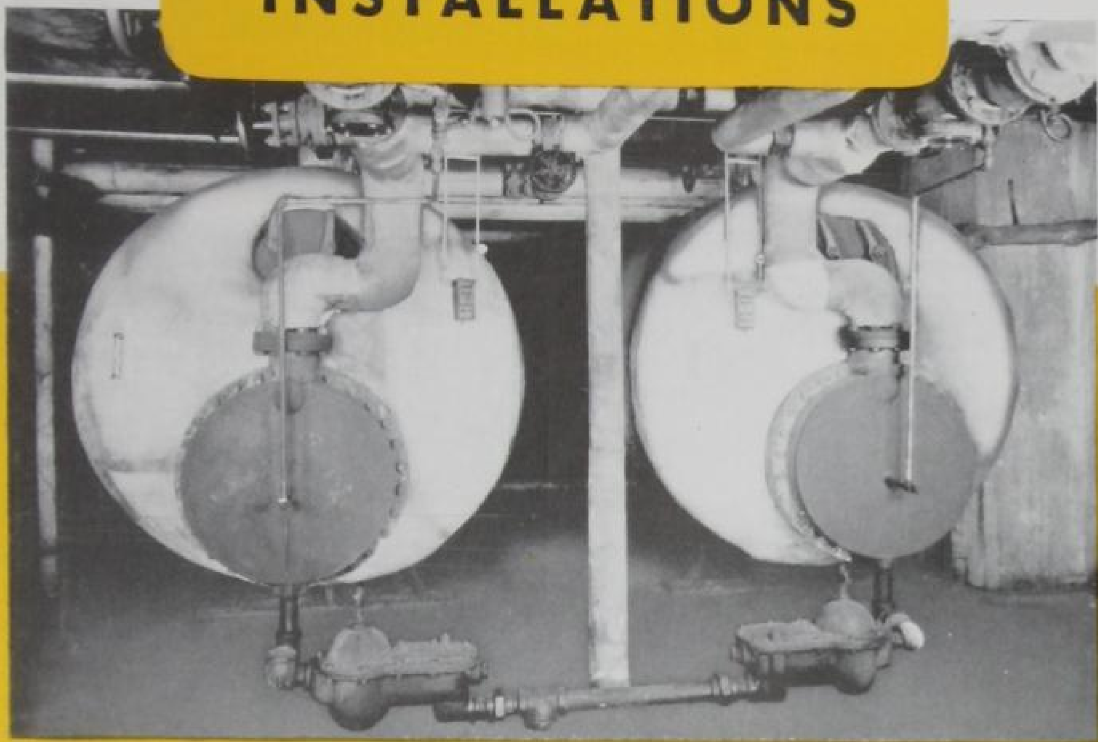


Fig. 4. Central Y.M.C.A., Minneapolis, Minn.

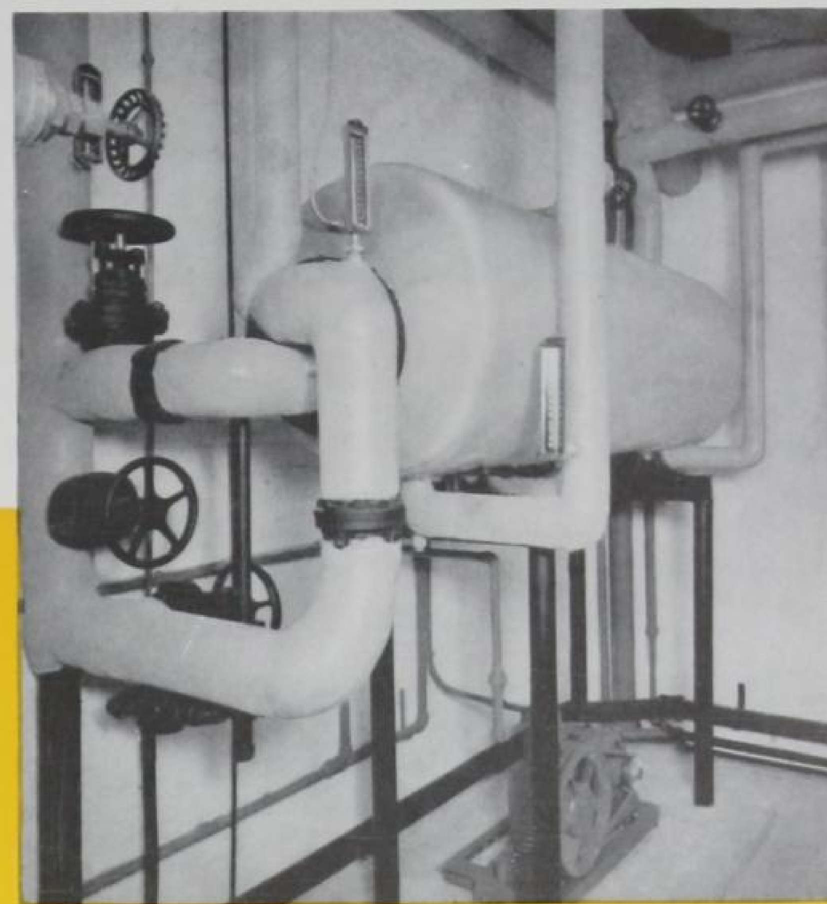


Fig. 5. Station KYW Studios, Philadelphia, Pa.

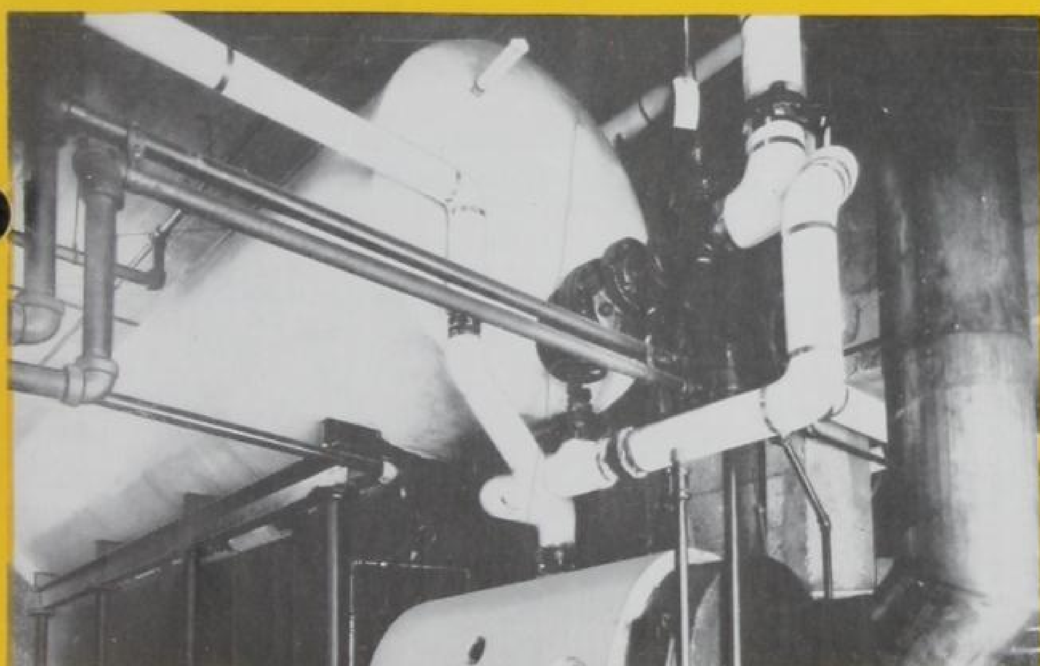


Fig. 6. Marlboro Apartments, Seattle, Wash.

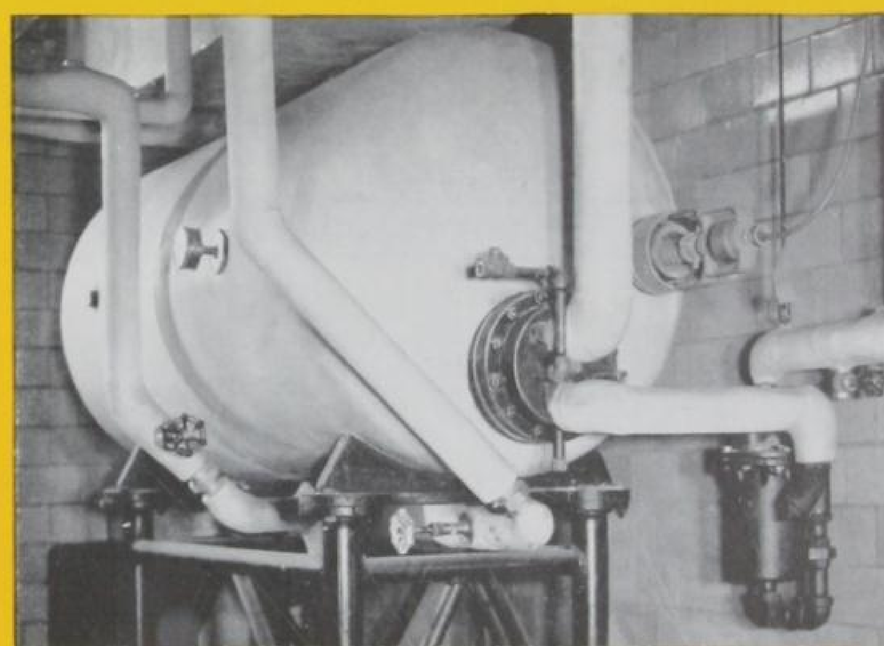


Fig. 7. Miami University, Oxford, Ohio

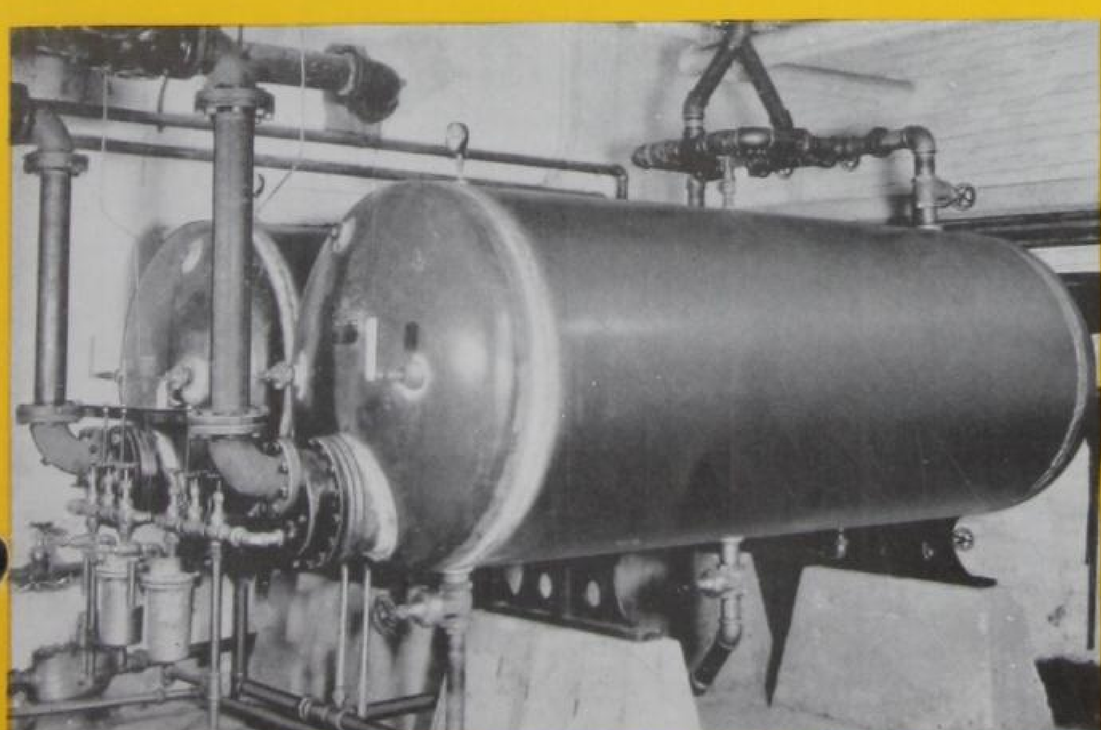


Fig. 8. Norwalk General Hospital, Norwalk, Conn.

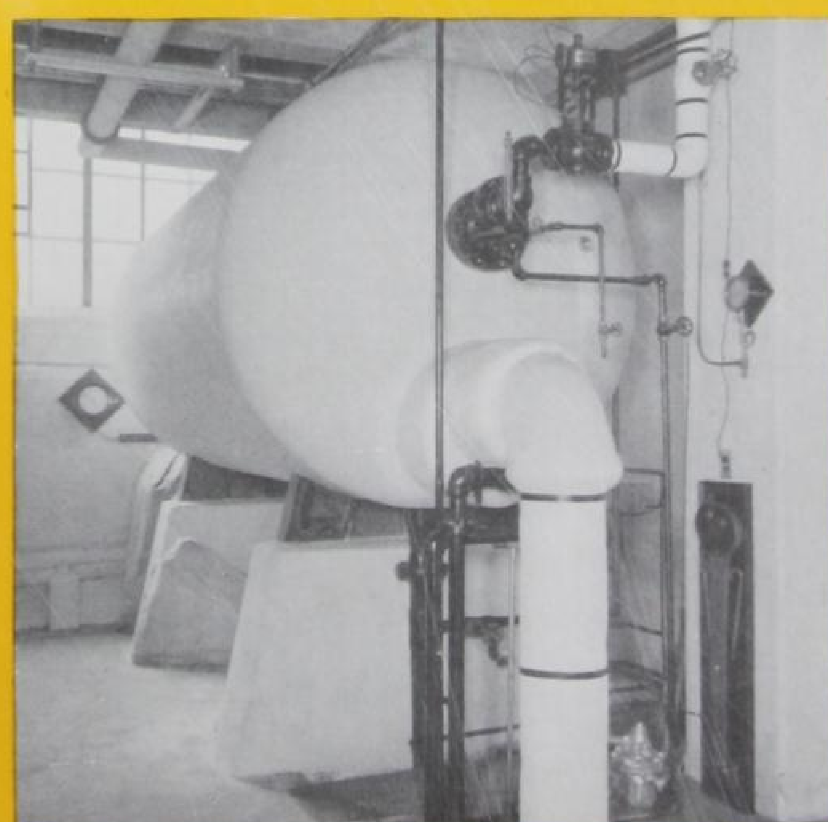
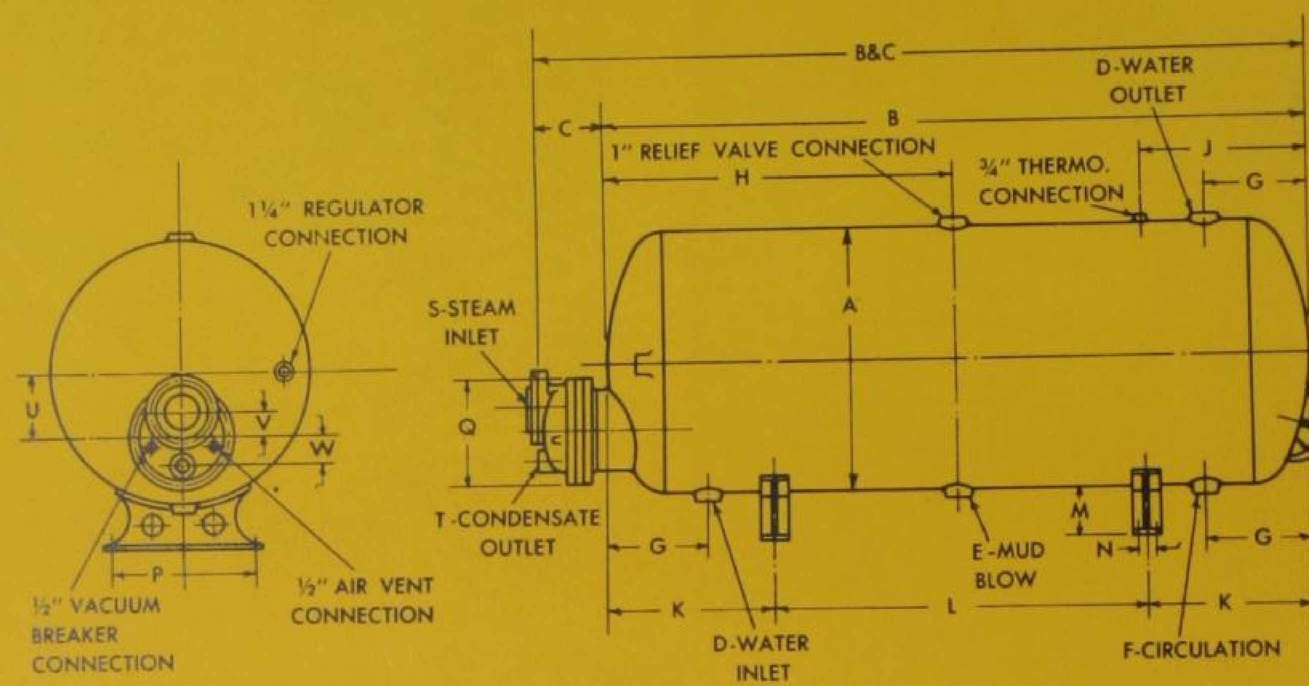


Fig. 9. Manheim Laundry, Philadelphia, Pa.

HORIZONTAL STORAGE HEATER DIMENSIONS



18" and 24" diameter shells have 6"x 8" hand-hole on centerline.

30" diameter shell has 11" x 15" manhole on centerline.

36" diameter and larger shells have 11" x 15" manhole off centerline, as shown.

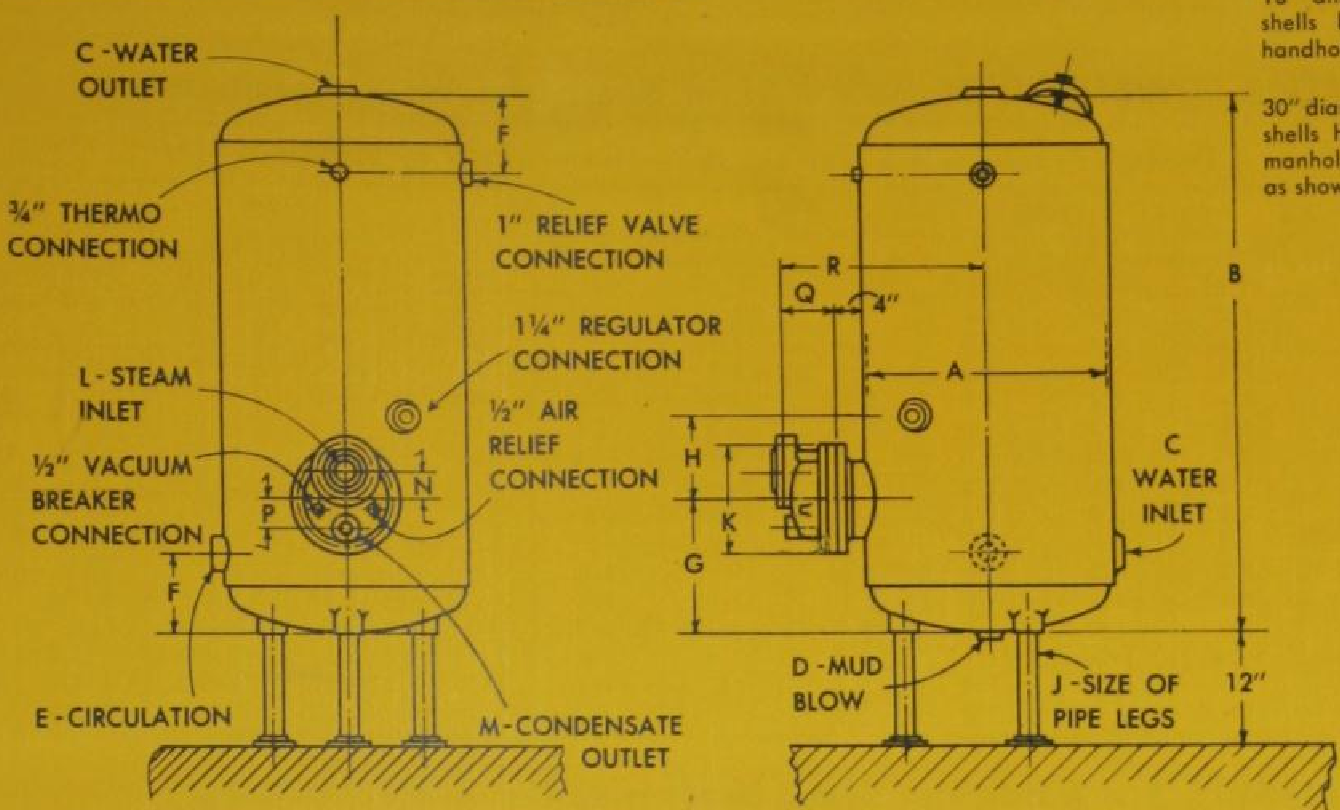
TABLE A—Shells

Number	Gallons—one filling	A—Diam. shell, in.	B—Length, in., add C—for overall	Weight—lbs. Approx.	D—Water inlet and outlet, in.	E—Mud blow, in.	F—Circulation, in.	G—Location of water connections, in.	H—Location of mud blow, in.	J—Location of thermometer, in.	K—Location of cradles, in.	L—c. c. of cradles, in.	Standard Cradles: M—Height, in.	Standard Cradles: N—c. c. of bolt holes, in.	Standard Cradles: P—c. c. of bolt holes, in.	Pipe Leg Cradles: N—Diam. of pipe legs, in.	Pipe Leg Cradles: P—c. c. of pipe legs in.
1	60	18	60	400	2	2	......	10	30	22	18	24	1⅞	1½	11	1¼	12¾
2	75	18	72	450	2	2	......	10	36	22	18	36	1⅞	1½	11	1¼	12¾
3	110	24	60	600	2	2	......	11	30	23	19	22	1⅞	1¾	14	1¼	17
4	130	24	72	700	2	2	......	11	36	23	19	34	1⅞	1¾	14	1¼	17
5	150	24	84	800	2	2	......	11	42	23	19	46	1⅞	1¾	14	1¼	17
6	170	30	60	750	3	2	......	12	30	24	20	20	3	1¾	19	2½	21¼
7	200	30	72	850	3	2	......	12	36	24	20	32	3	1¾	19	2½	21¼
8	240	30	84	950	3	2	......	12	42	24	20	44	3	1¾	19	2½	21¼
9	280	30	96	1050	3	2	......	12	48	24	20	56	3	1¾	19	2½	21¼
10	340	36	84	1300	3	2	......	14	42	26	22	40	3	1¾	21½	2½	24¾
11	400	36	96	1450	3	2	......	14	48	26	22	52	3	1¾	21½	2½	24¾
12	450	36	108	1600	3	2	......	14	54	26	22	64	3	1¾	21½	2½	24¾
13	500	36	120	1800	3	2	2	14	60	26	22	76	3	1¾	21½	2½	24¾
14	530	42	96	1850	4	2	......	17	48	29	26	44	3	2	25½	2½	29½
15	680	42	120	2150	4	2	2	17	60	29	26	68	3	2	25½	2½	29½
16	800	42	144	2500	4	2	2	17	72	29	26	92	3	2	25½	2½	29½
17	970	42	168	2900	4	2	2	17	84	29	26	116	3	2	25½	2½	29½
18	870	48	120	2850	4	2	2	18	60	30	27	66	2⅞	2	29	3	34
19	1050	48	144	3250	4	2	2	18	72	30	27	90	2⅞	2	29	3	34
20	1250	48	168	3700	4	2	2	18	84	30	27	114	2⅞	2	29	3	34
21	1400	48	192	4100	4	2	2	18	96	30	27	138	2⅞	2	29	3	34
22	1100	54	120	3250	4	2	2	20	60	32	30	60	2⅞	2	33	3	38
23	1300	54	144	3700	4	2	2	20	72	32	30	84	2⅞	2	33	3	38
24	1500	54	168	4200	4	2	2	20	84	32	30	108	2⅞	2	33	3	38
25	1800	54	192	4700	4	2	2	20	96	32	30	132	2⅞	2	33	3	38
26	1300	60	120	4300	4	2	2	20	60	32	30	60	3	2	37	3	42½
27	1600	60	144	4900	4	2	2	20	72	32	30	84	3	2	37	3	42½
28	1900	60	168	5600	4	2	2	20	84	32	30	108	3	2	37	3	42½
29	2200	60	192	6200	4	2	2	20	96	32	30	132	3	2	37	3	42½
29A	1950	66	144	5300	4	2	2	22	84	34	32	80	3	2	41	4	46½
29B	2300	66	168	6000	4	2	2	22	84	34	32	104	3	2	41	4	46½
29C	2650	66	192	7150	4	2	2	22	96	34	32	128	3	2	41	4	46½
30	2300	72	144	5700	4	2½	2½	23	72	35	34	76	3	6	40	4	51
31	2700	72	168	6400	4	2½	2½	23	84	35	34	100	3	6	40	4	51
32A	2700	78	144	7200	4	2½	2½	24	72	36	36	72	3	6	40	4	55¼
32B	3200	78	168	8050	4	2½	2½	24	84	36	36	96	3	6	40	4	55¼
32C	3700	78	192	8900	4	2½	2½	24	96	36	36	120	3	6	40	4	55¼

TABLE B—Heating Elements

Number	Gallons per hour 40°-180°F. steam at 0#	Smallest shell length into which section will fit, in.	Weight of entire section—lbs.	Q—Diam. of head port, in.	C—Add to B for over all, in.	S—Max. and std. steam inlet, in.	T—Max. and std. condensation, in.	U—Center heater to center of section	V—Location of steam inlet, in.	W—Location of
H0	100	48	75	9¼	6¼	2	1	Approx. ½ "A"—½ "Q" or ½ Diam. Shell Minus ½ Diam. Head Port	1 7/16	2
H1	150	60	80	9¼	6¼	2	1		1 7/16	2
H2	200	72	90	9¼	6¼	2	1		1 7/16	2
H3	250	84	100	9¼	6¼	2	1		1 7/16	2
H4	300	108	110	9¼	6¼	2	1		1 7/16	2
H5	350	120	115	9¼	6¼	2	1		1 7/16	2
H6	400	60	200	12½	7½	3	2		2¾	3
H7	500	72	210	12½	7½	3	2		2¾	3
H8	550	72	215	12½	7½	3	2		2¾	3
H9	600	84	220	12½	7½	3	2		2¾	3
H10	700	96	250	12½	7½	3	2		2¾	3
H11	800	96	260	12½	7½	3	2		2¾	3
H12	900	108	270	12½	7½	3	2		2¾	3
H13	1000	120	285	12½	7½	3	2		2¾	3
H14	1250	84	370	15¼	7½	5	2		2¾	4
H15	1500	108	425	15¼	7½	5	2		2¾	4
H16	1750	120	450	15¼	7½	5	2		2¾	4
H17	2000	96	570	18¼	8½	6	2½		3¼	[illegible]
H18	2400	120	620	18¼	8½	6	2½		3¼	[illegible]
H18A	2500	120	630	18¼	8½	6	2½		3¼	[illegible]
H19	2800	132	670	18¼	8½	6	2½		3¼	[illegible]
H19A	3000	132	695	18¼	8½	6	2½		3¼	[illegible]
H20	3200	96	860	21	9⅜	8	2½		4 5/16	[illegible]
H20A	3500	108	905	21	9⅜	8	2½		4 5/16	[illegible]
H21	3600	108	920	21	9⅜	8	2½		4 5/16	[illegible]
H22	4000	120	950	21	9⅜	8	2½		4 5/16	[illegible]
H23	4400	132	1020	21	9⅜	8	2½		4 5/16	[illegible]
H23A	4500	132	1040	21	9⅜	8	2½		4 5/16	[illegible]
H24	4800	96	1200	24	9⅝	10	3		5 5/16	[illegible]
H24A	5000	96	1235	24	9⅝	10	3		5 5/16	[illegible]
H25	5400	108	1300	24	9⅝	10	3		5 5/16	[illegible]
H26	6000	120	1380	24	9⅝	10	3		5 5/16	[illegible]
H27	7000	108	1900	28	11	10	3		6⅝	[illegible]
H27A	7500	108	1965	28	11	10	3		6⅝	[illegible]
H28	8000	120	2030	28	11	10	3		6⅝	[illegible]
H29	9000	132	2160	28	11	10	3		6⅝	[illegible]
H30	10000	144	2300	28	11	10	3		6⅝	[illegible]

VERTICAL STORAGE HEATER DIMENSIONS



18" and 24" diameter shells have 6" x 8" handhole off centerline.

30" diameter and larger shells have 11" x 15" manhole off centerline, as shown.

TABLE C—Shells

Number	Gallons—one filling	A—Diam. shell, in.	B—Length of shell, in.	Weight—lbs. approx.	C—Water inlet and outlet, in.	D—Mud blow, in.	E—Circulation, in.	F—Location water inlet, circulation, thermometer & relief valve	G—Location of heating section, in.	H—Location of regulator conn., in.	Pipe Leg Support: Number per unit	Pipe Leg Support: J—Size of pipe, in.
1V	60	18	60	400	2	2	...	10	12	9	3	¾
2V	75	18	72	450	2	2	...	10	12	9	3	¾
3V	110	24	60	600	2	2	...	11	15	10	3	1¼
4V	130	24	72	700	2	2	...	11	15	10	3	1¼
5V	150	24	84	800	2	2	...	11	15	10	3	1¼
6V	170	30	60	750	3	2	...	12	17	11	3	1¼
7V	200	30	72	850	3	2	...	12	17	11	3	1¼
8V	240	30	84	950	3	2	...	12	17	11	3	1¼
9V	280	30	96	1050	3	2	...	12	17	11	3	1¼
10V	340	36	84	1300	3	2	...	14	19	11	3	2½
11V	400	36	96	1450	3	2	...	14	19	11	3	2½
12V	450	36	108	1600	3	2	...	14	19	11	3	2½
13V	500	36	120	1800	3	2	2	14	19	11	3	2½
14V	530	42	96	1850	4	2	...	17	21	13	3	2½
15V	680	42	120	2150	4	2	2	17	21	13	3	2½
16V	800	42	144	2500	4	2	2	17	23	15	3	2½
17V	970	42	168	2900	4	2	2	17	23	15	3	2½
18V	870	48	120	2850	4	2	2	18	24	15	3	2½
19V	1050	48	144	3250	4	2	2	18	27	18	3	2½
20V	1250	48	168	3700	4	2	2	18	27	18	3	2½
21V	1400	48	192	4100	4	2	2	18	27	18	3	2½
22V	1100	54	120	3250	4	2	2	20	29	18	3	3
23V	1300	54	144	3700	4	2	2	20	29	18	3	3
24V	1500	54	168	4200	4	2	2	20	29	18	3	3
25V	1800	54	192	4700	4	2	2	20	29	18	3	3
26V	1300	60	120	4300	4	2	2	20	33	20	3	4
27V	1600	60	144	4900	4	2	2	20	33	20	3	4
28V	1900	60	168	5600	4	2	2	20	33	20	3	4
29V	2200	60	192	6200	4	2	2	20	33	20	3	4

TABLE D—Heating Elements

Number	Gallons 40°—180°F. per hour, steam 0#	Minimum shell diameter section will fit, in.	Weight of entire section—lbs.	K—Diameter of tube section and port, in.	L—Maximum and standard steam inlet, in.	M—Maximum and standard condensation, in.	N—Location of steam inlet, in.	P—Location of condensation, in.	Q—Face of port to face of steam inlet, in.	R—Distance from center of shell to face of steam inlet, in.
HV-1	150	18	160	12½	3	2	2¾	3⅜	5	18
HV-2	200	24	170	12½	3	2	2¾	3⅜	5	21
HV-3	250	24	250	12½	3	2	2¾	3⅜	5	21
HV-4	300	36	255	12½	3	2	2¾	3⅜	5	27
HV-5	350	36	260	12½	3	2	2¾	3⅜	5	27
HV-6	400	42	335	12½	3	2	2¾	3⅜	5	30
HV-7	500	30	340	15¼	5	2	2¾	4½	5	24
HV-8	550	30	350	15¼	5	2	2¾	4½	5	24
HV-9	600	36	360	15¼	5	2	2¾	4½	5	27
HV-10	700	36	375	15¼	5	2	2¾	4½	5	27
HV-11	800	42	385	15¼	5	2	2¾	4½	5	30
HV-12	900	36	400	18¼	6	2½	3¼	5½	6	28
HV-13	1000	42	415	18¼	6	2½	3¼	5½	6	31
HV-14	1250	48	570	18¼	6	2½	3¼	5½	6	34
HV-15	1500	42	600	21	8	2½	4 5/16	6⅞	6⅞	31⅞
HV-16	1750	48	790	21	8	2½	4 5/16	6⅞	6⅞	34⅞
HV-17	2000	54	830	21	8	2½	4 5/16	6⅞	6⅞	37⅞
HV-18	2400	60	880	21	8	2½	4 5/16	6⅞	6⅞	40⅞
HV-19	2800	54	1340	24	10	3	5 5/16	8⅛	7⅛	38⅛
HV-20	3200	60	1430	24	10	3	5 5/16	8⅛	7⅛	41⅛
HV-21	3600	66	1470	24	10	3	5 5/16	8⅛	7⅛	44⅛
HV-22	4000	72	1510	24	10	3	5 5/16	8⅛	7⅛	47⅛
HV-23	4400	72	1560	28	10	3	6⅝	9⅞	7¾	47¾
HV-24	4800	72	1600	28	10	3	6⅝	9⅞	7¾	47¾
HV-25	5400	72	1700	28	10	3	6⅝	9⅞	7¾	47¾
HV-26	6000	84	1800	28	10	3	6⅝	9⅞	7¾	53¾
HV-27	7000	84	2440	30	12	4	6½	10½	8⅜	54⅜
HV-28	8000	84	2500	30	12	4	6½	10½	8⅜	54⅜
HV-29	9000	84	2880	36	14	5	7 7/16	12¾	10	56
HV-30	10000	84	3070	36	14	5	7 7/16	12¾	10	56

PRESSURE THICKNESS TABLES
STEEL SHELL HEATERS

CORROSION ALLOWANCE: As steel is subject to moderate corrosion by oxygen released from water being heated, it is good practice to add an allowance of $\frac{1}{16}''$ to $\frac{1}{8}''$ to the pressure thickness to act as corrosion allowance for greater durability.

TABLE E — Whitlock Standard Steel Shell and Head Thicknesses

Design Pressure lbs. per sq. in. — Dimensions in Inches

SHELL DIAM.	75 THICKNESS		100 THICKNESS		125 THICKNESS		150 THICKNESS		175 THICKNESS		200 THICKNESS	
	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD
18	**1/4**	**3/8**	**1/4**	**3/8**	**1/4**	**3/8**	**1/4**	**3/8**	**1/4**	**3/8**	**1/4**	**3/8**
24	**1/4**	**3/8**	**1/4**	**3/8**	**1/4**	**3/8**	**1/4**	**3/8**	**1/4**	**3/8**	5/16	1/2
30	**1/4**	**3/8**	**1/4**	**3/8**	**1/4**	**3/8**	5/16	1/2	5/16	1/2	3/8	1/2
36	**1/4**	**3/8**	**1/4**	**3/8**	**5/16**	**1/2**	**5/16**	**1/2**	3/8	1/2	7/16	9/16
42	**1/4**	**3/8**	**1/4**	**3/8**	**5/16**	**1/2**	**3/8**	**1/2**	7/16	9/16	9/16	11/16
48	**5/16**	**1/2**	**5/16**	**1/2**	**3/8**	**1/2**	7/16	9/16	9/16	11/16	5/8	3/4
54	**3/8**	**1/2**	**3/8**	**1/2**	**7/16**	**9/16**	1/2	5/8	9/16	11/16	5/8	3/4
60	**3/8**	**1/2**	**3/8**	**1/2**	**7/16**	**9/16**	9/16	11/16	5/8	3/4	3/4	7/8
66	3/8	1/2	3/8	1/2	1/2	5/8	9/16	11/16	3/4	7/8	3/4	15/16
72	5/16	1/2	**1/2**	**5/8**	9/16	11/16	5/8	3/4	3/4	7/8	7/8	1
78	3/8	1/2	1/2	5/8	9/16	11/16	3/4	7/8	13/16	1	15/16	1-1/8
84	3/8	1/2	**1/2**	**5/8**	5/8	3/4	3/4	15/16	7/8	1-1/16	1	1-3/16
96	7/16	9/16	9/16	11/16	3/4	7/8	7/8	1-1/16	1	1-1/4	1-1/8	1-3/8
108	1/2	5/8	3/4	7/8	7/8	1	15/16	1-3/16	1-1/16	1-3/8	1-1/4	1-9/16
120	9/16	11/16	3/4	7/8	7/8	1-1/8	1-1/16	1-5/16	1-3/16	1-9/16	1-3/8	1-3/4

TABLE F — Minimum Steel Shell and Head Thicknesses Furnished for A.S.M.E. Code Stamped Heaters

Design Pressure lbs. per sq. in. — Dimensions in Inches

SHELL DIAM.	75 THICKNESS		100 THICKNESS		125 THICKNESS		150 THICKNESS		175 THICKNESS		200 THICKNESS	
	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD
18	Shell and head thicknesses will not be furnished less than ¼″ although A.S.M.E. Code may allow lesser thicknesses for these conditions.										**1/4**	**5/16**
24							**1/4**	**5/16**	**1/4**	**3/8**	5/16	3/8
30					**1/4**	**5/16**	5/16	3/8	5/16	7/16	3/8	1/2
36			**1/4**	**5/16**	**5/16**	**3/8**	**5/16**	**7/16**	3/8	1/2	7/16	9/16
42			**1/4**	**3/8**	**5/16**	**7/16**	**3/8**	**1/2**	7/16	9/16	1/2	11/16
48	1/4	5/16	**5/16**	**3/8**	**3/8**	**1/2**	**7/16**	**9/16**	1/2	11/16	9/16	3/4
54	1/4	5/16	5/16	3/8	**7/16**	**1/2**	1/2	9/16	9/16	11/16	5/8	3/4
60	5/16	5/16	**3/8**	**7/16**	**7/16**	**9/16**	9/16	5/8	5/8	3/4	11/16	7/8
66	5/16	3/8	3/8	1/2	1/2	5/8	9/16	11/16	11/16	13/16	3/4	15/16
72	5/16	3/8	7/16	1/2	9/16	5/8	5/8	3/4	3/4	7/8	13/16	1
78	3/8	7/16	1/2	9/16	9/16	11/16	11/16	7/8	13/16	1	15/16	1-1/8
84	3/8	1/2	**1/2**	**5/8**	5/8	3/4	3/4	15/16	7/8	1-1/16	1	1-3/16
96	7/16	9/16	9/16	11/16	11/16	7/8	7/8	1-1/16	1	1-1/4	1-1/8	1-3/8
108	1/2	5/8	5/8	13/16	13/16	1	15/16	1-3/16	1-1/16	1-3/8	1-1/4	1-9/16
120	9/16	11/16	11/16	7/8	7/8	1-1/8	1-1/16	1-5/16	1-3/16	1-9/16	1-3/8	1-3/4

NOTES: Thicknesses are expressed in not less than multiples of sixteenths of an inch. Manhole frame is properly reinforced to meet A.S.M.E. Code requirements, and gasket surface is machined.

Plate and heads as listed in above tables are regularly carried in our stock for many sizes of heaters. Stock is held within a reasonable minimum by eliminating the stocking of less commonly used sizes. Sizes shown in bold face type represent heaters for which raw materials are carried in stock at all times.

FOR ALL WHITLOCK TYPE K STORAGE HEATERS — Shells 30″ in diameter and larger are provided with 11″ x 15″ manhole in one head. Shells smaller than 30″ diameter are provided with 6″ x 8″ handholes.

A.S.M.E. CODE STAMPED HEATERS (TABLES F AND K) — The thicknesses given are in accordance with the rules according to the 1949 A.S.M.E. Code for Unfired Pressure Vessels. These rules were continued in the 1950 Code, accompanied by an alternate basis for design which, in general, permits slightly lesser shell and head thicknesses for a given diameter of shell and a given design pressure, but only when accompanied by compliance with certain additional requirements as to manufacturing procedure, etc.

The implications of these permissive alternate rules have been carefully analyzed and it is our present considered opinion that adherence to the rules of the 1949 Code will give to the user of a steel shell storage type water heater a better value for the investment than adherence to the alternate permissive rules. We are therefore continuing, in this edition of Bulletin No. 40A, the above table unchanged.

There is another consideration which must be kept in mind. A number of states and cities currently require that all storage type water heaters installed within the limits of their respective jurisdictions comply with the requirements of the existing (1949 and earlier) rules of the A.S.M.E. Code for unfired pressure vessels. Until these authorities have formally accepted the 1950 Code, with the alternate permissive rules referred to above, it will presumably be necessary to continue compliance with the 1949 Code in connection with the manufacture of storage type water heaters to be installed within the limits of their respective jurisdictions.

A heater which does not bear the A.S.M.E. clover leaf stamped on the shell is *not constructed* in full accordance with the A.S.M.E. Code. All Whitlock heaters which are constructed in full accordance with the A.S.M.E. Code are so stamped.

LOOK FOR THE CLOVER LEAF.

PRESSURE THICKNESS TABLES EVERDUR SHELL HEATERS

Shell and head thicknesses as they appear in Tables G and K below have been carefully calculated to minimize the effect of stress corrosion cracking which can result with certain water conditions when high stress and temperature levels occur in service.

TABLE G — Minimum Everdur Shell and Head Thicknesses Whitlock Standard Construction

(Test Pressure = 1½ times Design Pressure)

Design Pressure lbs. per sq. in. — Dimensions in Inches

SHELL DIAM.	75		100		125		150		175		200	
	THICKNESS		THICKNESS		THICKNESS		THICKNESS		THICKNESS		THICKNESS	
	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD
18	0.067	0.107	0.090	0.143	0.112	0.178	0.134	0.214	0.157	0.250	0.178	0.285
24	0.090	0.125	0.120	0.166	0.149	0.208	0.179	0.250	0.209	0.291	0.238	0.334
30	0.112	0.143	0.150	0.190	0.186	0.238	0.224	0.286	0.261	0.333	0.298	0.381
36	0.134	0.178	0.180	0.238	0.224	0.298	0.268	0.358	0.313	0.416	0.357	0.475
42	0.157	0.214	0.210	0.286	0.261	0.357	0.313	0.428	0.365	0.500	0.417	0.571
48	0.179	0.250	0.240	0.333	0.298	0.416	0.358	0.500	0.417	0.583	0.476	0.666
54	0.201	0.286	0.270	0.380	0.336	0.476	0.404	0.570	0.470	0.666	0.535	0.761
60	0.224	0.321	0.300	0.429	0.373	0.536	0.448	0.642	0.522	0.750	0.596	0.856
66	0.246	0.355	0.330	0.476	0.410	0.596	0.492	0.714	0.572	0.831	0.655	0.951
72	0.269	0.393	0.360	0.524	0.447	0.655	0.538	0.785	0.626	0.915	0.714	1.049
78	0.291	0.427	0.390	0.571	0.485	0.715	0.582	0.856	0.676	1.000	0.772	1.142
84	0.314	0.464	0.420	0.619	0.522	0.775	0.627	0.930	0.730	1.081	0.832	1.238
96	0.359	0.535	0.480	0.714	0.596	0.895	0.716	1.072	0.835	1.250	0.951	1.430
108	0.403	0.606	0.540	0.810	0.672	1.010	0.806	1.140	0.940	1.330	1.070	1.525
120	0.447	0.677	0.600	0.904	0.746	1.075	0.895	1.285	1.045	1.500	1.190	1.710

TABLE H — Minimum Everdur Shell and Head Thicknesses A.S.M.E. Code Construction

Design Pressure lbs. per sq. in. — Dimensions in Inches

SHELL DIAM.	75		100		125		150		175		200	
	THICKNESS		THICKNESS		THICKNESS		THICKNESS		THICKNESS		THICKNESS	
	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD
18	0.084	0.113	0.112	0.150	0.140	0.188	0.168	0.200	0.195	0.205	0.223	0.300
24	0.113	0.132	0.150	0.175	0.188	0.188	0.228	0.263	0.261	0.307	0.298	0.350
30	0.141	0.150	0.188	0.200	0.234	0.250	0.279	0.300	0.326	0.350	0.372	0.400
36	0.169	0.188	0.224	0.250	0.280	0.313	0.335	0.375	0.391	0.438	0.446	0.500
42	0.197	0.225	0.261	0.300	0.327	0.375	0.391	0.450	0.456	0.525	0.521	0.600
48	0.225	0.263	0.299	0.350	0.373	0.438	0.447	0.525	0.522	0.613	0.595	0.700
54	0.253	0.300	0.336	0.400	0.420	0.500	0.502	0.600	0.586	0.700	0.670	0.800
60	0.281	0.338	0.373	0.450	0.466	0.563	0.558	0.675	0.652	0.788	0.743	0.900
66	0.309	0.375	0.411	0.500	0.513	0.625	0.615	0.750	0.716	0.875	0.819	1.000
72	0.337	0.413	0.448	0.550	0.560	0.688	0.670	0.825	0.782	0.963	0.892	1.100
78	0.365	0.450	0.485	0.600	0.606	0.750	0.726	0.900	0.846	1.050	0.966	1.200
84	0.393	0.488	0.523	0.650	0.653	0.813	0.782	0.975	0.913	1.138	1.040	1.300
96	0.449	0.563	0.597	0.750	0.744	0.938	0.894	1.125	1.043	1.313	1.190	1.500
108	0.505	0.638	0.672	0.850	0.840	1.063	1.006	1.200	1.172	1.400	1.340	1.600
120	0.561	0.713	0.746	0.950	0.934	1.125	1.118	1.350	1.302	1.575	1.485	1.800

TABLE K — Minimum Everdur Shell and Head Thicknesses Where Working Pressure Shall Not Exceed 42½% of Test Pressure.*

(For Special Municipal or State Regulations)

Pressure lbs. per sq. in. — Dimensions in Inches.

SHELL DIAM.	Test Pressure							
	200		250		300		350	
	Working Pressure							
	85		106.25		127.5		148.75	
	THICKNESS		THICKNESS		THICKNESS		THICKNESS	
	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD
18	0.096	0.128	0.120	0.160	0.143	0.192	0.166	0.224
24	0.127	0.149	0.159	0.186	0.191	0.224	0.221	0.261
30	0.159	0.170	0.199	0.213	0.238	0.255	0.277	0.298
36	0.191	0.213	0.238	0.266	0.286	0.319	0.332	0.372
42	0.223	0.255	0.278	0.319	0.333	0.383	0.387	0.446
48	0.254	0.298	0.318	0.372	0.381	0.447	0.443	0.521
54	0.286	0.340	0.358	0.425	0.428	0.510	0.497	0.595
60	0.318	0.383	0.398	0.478	0.476	0.574	0.552	0.670
66	0.349	0.425	0.436	0.531	0.524	0.638	0.609	0.744
72	0.381	0.468	0.476	0.584	0.571	0.702	0.665	0.819
78	0.413	0.510	0.516	0.637	0.618	0.766	0.720	0.893
84	0.445	0.553	0.556	0.690	0.666	0.829	0.775	1.042
96	0.508	0.638	0.635	0.796	0.761	0.957	0.785	1.116
108	0.572	0.723	0.715	0.903	0.856	1.085	0.995	1.190
120	0.635	0.808	0.795	1.009	0.951	1.148	1.103	1.339

*Thicknesses also suitable for A.S.M.E. Code construction for working pressures indicated.

SELECTING PROPER SIZE HEATER

The size of Whitlock Type K Storage Heater required for different types of buildings can be determined from Table L as follows:

Hourly heating capacity = Hourly requirement x Hourly heating capacity factor.

Storage capacity = Hourly heating capacity x Storage capacity factor.

Reference to Tables A to D will show correct size of shell and heating section at once.

EXAMPLE:

To illustrate the above method of selecting the proper heater, take the hot water requirements of a small hotel.

Private lavatories	100 @	2 gals. each	200 gals. per hr.
Public lavartories	10 @	8 gals. each	80 gals. per hr.
Bathtubs	75 @	20 gals. each	1,500 gals. per hr.
Dishwashers	2 @	50 gals. each	100 gals. per hr.
Kitchen sinks	3 @	20 gals. each	60 gals. per hr.
Pantry sinks	2 @	10 gals. each	20 gals. per hr.
Showers	24 @	75 gals. each	1,800 gals. per hr.
Slop sinks	8 @	30 gals. each	240 gals. per hr.
Maximum hourly requirements (total)			4,000 gals. per hr.

Hourly heating capacity equals 4,000 multiplied by 25% (hourly heating capacity factor) or 1,000 gal. per hour.

Storage capacity equals 1,000 multiplied by 80% (storage capacity factor) or 800 gal.

Shell size for 800 gal., No. 16 (42 x 144 in.). Heating section of 1,000 gal. capacity is No. H13. Heater required is Whitlock Type K No. 16H13 (or No. 16V HV13 vertical).

STEAM REQUIRED TO HEAT WATER

The amount of steam per hour required to heat a given quantity of water through any temperature range and with any steam pressure can be determined from the following formula:

$$\frac{\text{Gallons per Hour} \times 8.33 \times \text{Degrees Rise}}{\text{Latent Heat of Steam}} = \text{Pounds of steam per hour.}$$

EXAMPLE: Required the amount of steam at 50 lbs. pressure to heat 10,000 G.P.H. from 40° to 180°.

$$\frac{10{,}000 \times 8.33 \times 140}{911} = 12{,}801 \text{ lbs. steam per hour.}$$

TABLE M — Latent Heat of Steam

Steam Pressure, lbs. gage	0	5	10	15	20	30	35	40
Latent Heat (B.t.u.)	970	960	952	945	939	928	924	919
Steam Pressure, lbs. gage	45	50	55	60	65	70	75	80
Latent Heat (B.t.u.)	915	911	908	904	901	898	893	891
Steam Pressure, lbs. gage	85	90	95	100	105	110	115	120	125
Latent Heat (B.t.u.)	888	886	883	880	877	875	872	870	868

TABLE L — Hot Water Fixture Capacity for Various Types of Buildings

Gallons of 180°F. Water per Hour per Fixture

	Apartment house	Club	Gymnasium	Hospital	Hotel	Industrial plant	Office building	Public bath	Private residence	School	Y. M. C. A.
Basins, private lavatory	2	2	2	2	2	2	2	2	2	2	2
Basins, public lavatory	4	6	8	6	8	12	6	12	..	15	8
Bathtubs	20	20	30	20	20	30	..	45	20	..	30
Dishwashers	15	50-150	..	50-150	50-200	20-100	..	..	15	20-100	20-100
Foot basins	3	3	12	3	3	12	..	..	3	3	12
Kitchen sink	10	20	..	20	20	20	..	..	10	10	20
Laundry, stationary tubs	20	28	..	28	28	..	..	..	20	..	28
Pantry sink	5	10	..	10	10	..	..	..	5	10	10
Showers	75	150	225	75	75	225	..	225	75	225	225
Slop sink	20	20	..	20	30	20	15	15	15	20	20
Hourly heating capacity factor	30%	30%	40%	25%	25%	40%	30%	50%	30%	40%	40%
Storage capacity factor	125%	90%	100%	60%	80%	100%	200%	120%	70%	100%	100%

CONVERSION FACTORS

The heating capacities of standard Whitlock Type K heating elements listed on Pages 6 and 7 are based on heating the indicated flow rates from 40° to 180°F. when using steam at atmospheric pressure. In actual practice, however, conditions such as steam pressure, initial and final temperature may vary considerably from these standards. In order to compensate for these variables we list below suitable Conversion Factors which are generally adequate for installations where the ratio of hourly heating capacity to storage capacity does not exceed approximately 4 to 1.

To apply these factors locate the appropriate steam pressure table, start at the top of this table with the proper initial water temperature, and move down that column to the required outlet water temperature indicated in the vertical columns to the left. The factors thus obtained, when multiplied by the standard ratings on Pages 6 and 7, give ratings for the required conditions. Typical examples of the use of the tables may be helpful:

EXAMPLE NO. 1. Determine capacity of H-13 heating element when heating water from 50° to 150°F. with steam at 25 lbs. gage. Using the tables as indicated above we arrive at a factor of 2.87. With the standard rating of an H-13 heating element 1,000 G.P.H., we multiply 1,000 x 2.87 which gives a rating of 2,870 G.P.H. for the required conditions.

EXAMPLE NO. 2. Determine standard heating element required to heat 2,400 G.P.H. water from 60° to 180°F. when supplied with 40 lbs. gage steam. Again determining the conversion factor as above we arrive at 2.42. Now dividing: 2,400 ÷ 2.42 equals 992 G.P.H. (standard rating). An H-13 heating element with a standard 1,000 G.P.H. rating is satisfactory.

TABLE N — Conversion Factors

STEAM PRESSURE, LBS. GAGE	0			5			10			15			20		
INITIAL TEMP.	40	50	60	40	50	60	40	50	60	40	50	60	40	50	60
FINAL TEMP:															
100	3.93	4.57	5.53	4.41	5.12	6.22	4.81	5.58	6.83	5.14	6.04	7.34	5.47	6.42	7.82
120	2.69	2.98	3.36	3.05	3.38	3.83	3.35	3.72	4.23	3.61	4.02	4.56	3.85	4.30	4.89
140	1.94	2.08	2.26	2.23	2.41	2.61	2.47	2.67	2.91	2.68	2.89	3.16	2.87	3.12	3.41
150	1.65	1.76	1.88	1.92	2.05	2.20	2.15	2.29	2.47	2.33	2.50	2.70	2.51	2.69	2.91
160	1.41	1.48	1.57	1.66	1.76	1.87	1.87	1.99	2.11	2.05	2.17	2.27	2.21	2.35	2.51
180	1.00	1.04	1.08	1.23	1.29	1.34	1.42	1.48	1.56	1.58	1.65	1.73	1.72	1.80	1.90
190	......	......	......	1.05	1.09	1.13	1.23	1.28	1.33	1.38	1.44	1.51	1.52	1.58	1.66
200	......	......	......	0.88	0.906	0.934	1.06	1.09	1.14	1.21	1.25	1.30	1.34	1.39	1.44

STEAM PRESSURE, LBS. GAGE	25			30			40			50			60		
INITIAL TEMP.	40	50	60	40	50	60	40	50	60	40	50	60	40	50	60
FINAL TEMP:															
100	5.75	6.76	8.23	6.03	7.06	8.64	6.53	7.66	9.42	6.99	8.24	10.08	7.40	8.77	10.73
120	4.08	4.54	5.17	4.26	4.78	5.43	4.63	5.18	5.90	4.98	5.58	6.38	5.30	5.93	6.78
140	3.06	3.30	3.62	3.20	3.48	3.82	3.50	3.81	4.20	3.78	4.12	4.52	4.02	4.37	4.81
150	2.67	2.87	3.10	2.81	3.02	3.28	3.09	3.32	3.59	3.34	3.59	3.89	3.55	3.82	4.17
160	2.36	2.50	2.68	2.49	2.64	2.83	2.73	2.91	3.13	2.96	3.17	3.40	3.16	3.37	3.63
180	1.85	1.94	2.04	1.96	2.06	2.17	2.17	2.28	2.42	2.37	2.50	2.64	2.51	2.68	2.83
190	1.64	1.71	1.79	1.74	1.82	1.91	1.95	2.04	2.14	2.13	2.23	2.35	2.29	2.39	2.53
200	1.45	1.51	1.57	1.55	1.61	1.68	1.74	1.81	1.90	1.92	2.00	2.09	2.06	2.15	2.27

STEAM PRESSURE, LBS. GAGE	70			80			90			100			125		
INITIAL TEMP.	40	50	60	40	50	60	40	50	60	40	50	60	40	50	60
FINAL TEMP:															
100	7.84	9.28	11.39	8.25	9.74	11.80	8.60	10.14	12.44	9.00	10.61	13.00	9.84	11.71	15.23
120	5.62	6.30	7.19	5.91	6.65	7.58	6.17	6.94	7.91	6.46	7.28	8.33	7.16	8.05	9.16
140	4.26	4.64	5.13	4.31	4.90	5.42	4.72	5.16	5.66	4.95	5.40	5.97	5.47	5.98	6.60
150	3.78	4.08	4.45	4.00	4.31	4.69	4.17	4.52	4.92	4.38	4.75	5.16	4.87	5.27	5.75
160	3.36	3.60	3.88	3.57	3.89	4.12	3.73	4.00	4.31	3.93	4.20	4.55	4.37	4.67	5.05
180	2.71	2.86	3.04	2.88	3.04	3.23	3.02	3.20	3.39	3.19	3.37	3.58	3.55	3.76	4.00
190	2.45	2.57	2.71	2.60	2.74	2.89	2.75	2.89	3.05	2.86	3.03	3.20	3.23	3.39	3.59
200	2.21	2.32	2.42	2.36	2.47	2.59	2.46	2.61	2.73	2.63	2.74	2.90	2.95	3.08	3.25

CONDENSATE COOLERS

Whitlock Type K Condensate Coolers are designed to cool returns from steam heating systems and steam-actuated equipment, thus partially or completely heating the required service water. The condensate passes through the heating element, giving up its heat to the water in the shell. Specifically, the condensate cooler

(1) effects a considerable fuel saving where the condensate would otherwise be dumped to waste or would flash upon its introduction to a receiver,

(2) cools condensate to a temperature at which it may be returned to the receiver or dumped to waste. In many cities local ordinances forbid the discharge of hot wastes to the sewer.

The Type K Condensate Cooler can be furnished in a standard single element design, with the condensate handling all of the heating load, or in a combination element design, as explained on Page 3, where the condensate as the primary heat source is augmented by live steam as required.

The storage type of condensate cooler is preferable to the instantaneous type when the demand for hot water is intermittent.

The capacity table to be found on this page provides full data for the selection of the suitable heating element size for the required installation. Physical dimensions for these heating elements will be found on pages 6 and 7. To determine the appropriate storage heater shell size refer to sizing data on Page 10. The capacity table below expresses the condensation in terms of pounds per hour and E.D.R. (Equivalent Direct Radiation—square feet). Economically it is reasonable to design the installation to recover as much heat as is possible from the condensate, and ratings are designated for three condensate outlet temperatures.

TABLE P — Capacity of Whitlock Condensation Cooling Sections

(For best economy select cooler large enough to extract most of the waste heat.)

Sq. ft. radiation	Equivalent condensation, lbs. per hr.	Cooling Condensation 200°-125° while heating an equal amount of service water, 50°-125°	Cooling Condensation 200°-100° while heating twice the amount of service water, 50°-100°	Cooling Condensation 200°-89° while heating three times the amount of service water, 50°-87°
1,000	250	H-0	H-0	H-0
1,500	375	H-1	H-1	H-1
2,000	500	H-1	H-2	H-2
2,500	625	H-2	H-3	H-3
3,000	750	H-3	H-4	H-4
3,500	875	H-3	H-5	H-5
4,000	1,000	H-4	H-5	H-6
5,000	1,250	H-5	H-7	H-7
6,000	1,500	H-6	H-8	H-8
7,000	1,750	H-7	H-9	H-10
8,000	2,000	H-8	H-10	H-11
10,000	2,500	H-10	H-12	H-13
12,500	3,125	H-12	H-14	H-14
15,000	3,750	H-13	H-14	H-15
17,500	4,275	H-14	H-15	H-16
20,000	5,000	H-15	H-16	H-17
25,000	6,250	H-16	H-18	H-18
30,000	7,500	H-17	H-19	H-19
35,000	8,750	H-18	H-20	H-20
40,000	10.000	H-19	H-21	H-22
		Refer to Table B for Shell Sizes Type K Sections will fit	Refer to Table B for Shell Sizes Type K Sections will fit	Refer to Table B for Shell Sizes Type K Sections will fit

Fig. 10. Installation of Condensation Cooler utilizing condensate from storage heater and building heating system

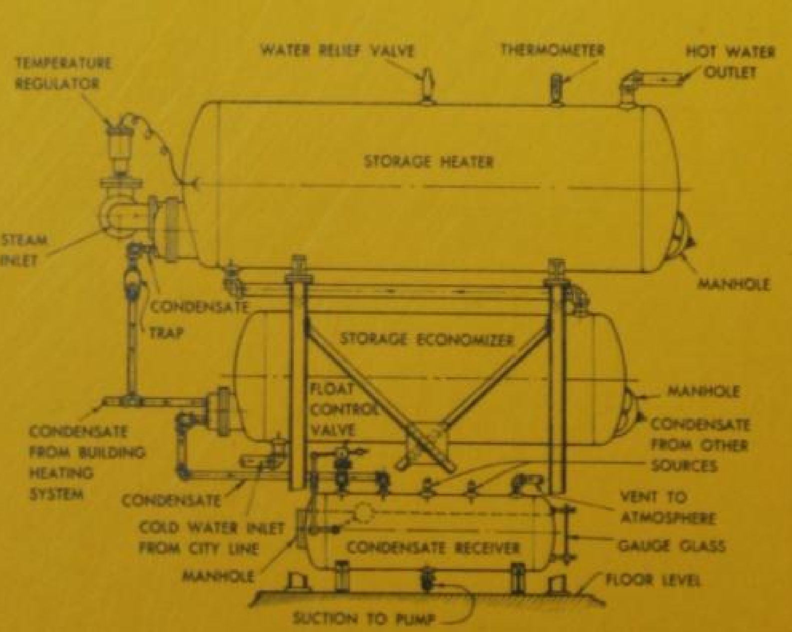
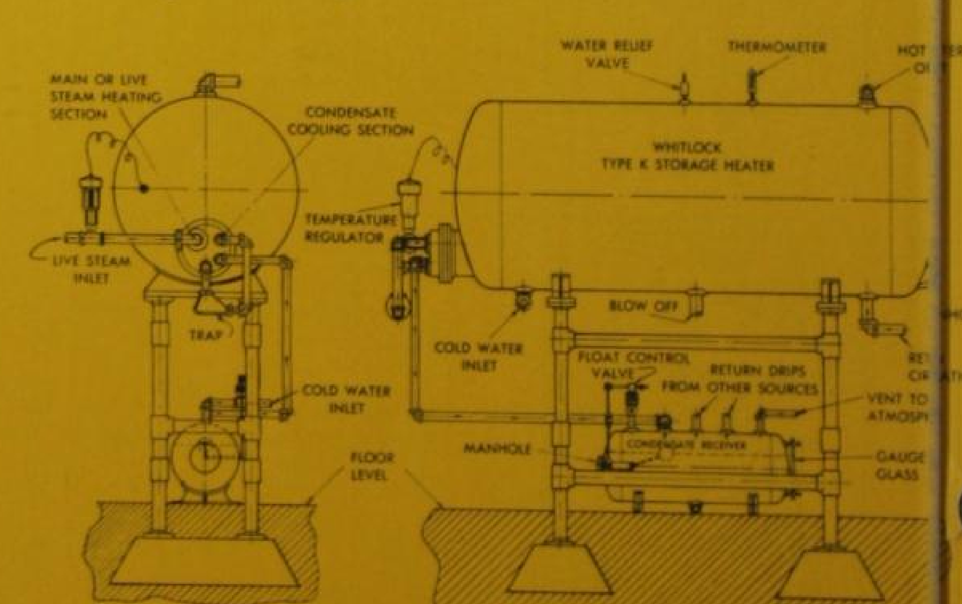


Fig. 11. Installation of Type K Heater with combined heatin[g] and condensation cooling section — handling condensation fro[m] heating section only



SUBMERGED HEATERS

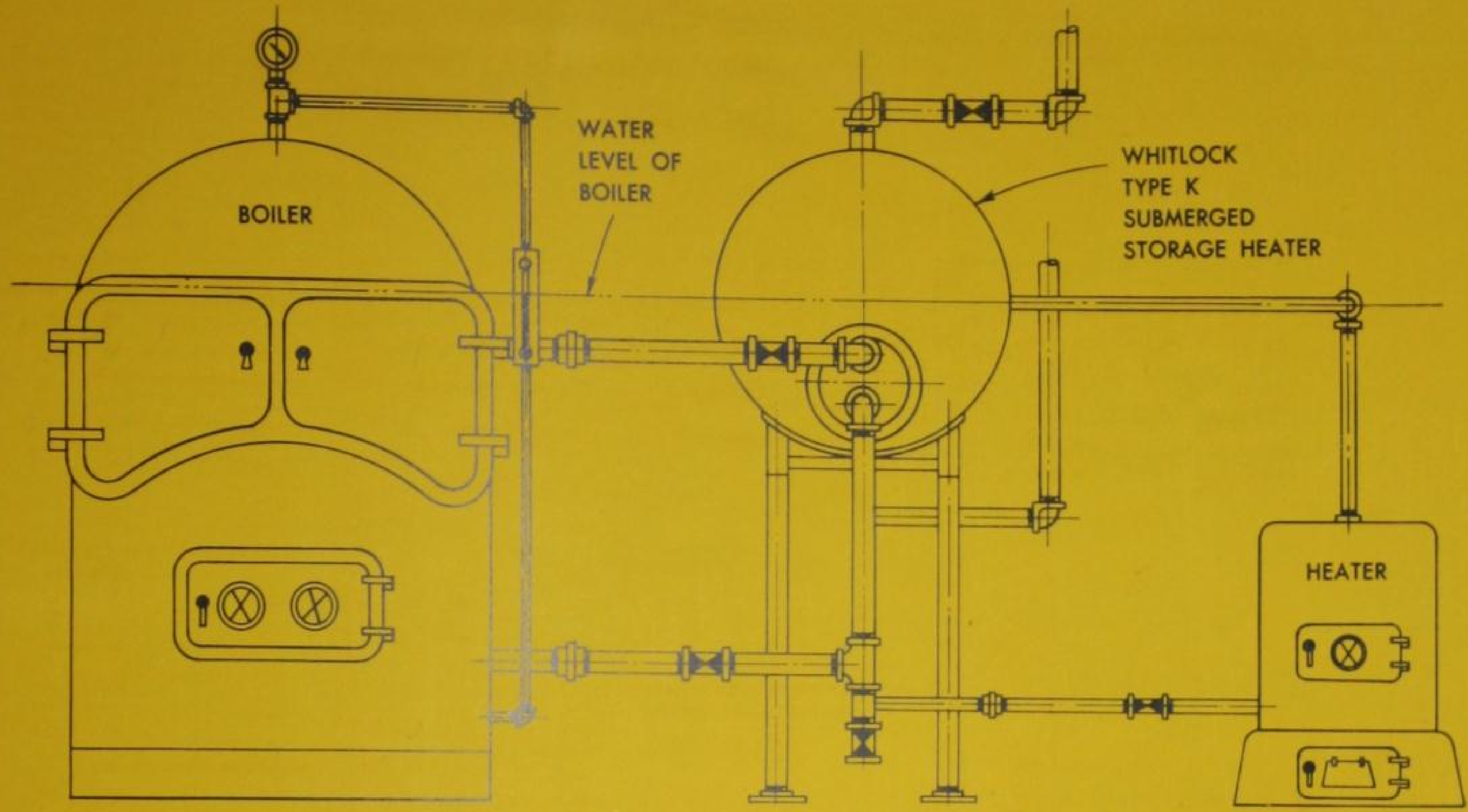


Fig. 12. Installation of Submerged Storage Heater

With the Whitlock Submerged Type K Heater the heating element is placed below the water line of the boiler. Boiler water heats the domestic service supply with a relatively small but steady transfer of heat from boiler water to domestic supply. The removal of heat from the boiler in this manner, since the amount is relatively small and is steady, does not appreciably reduce the steaming capacity of the boiler.

Advantages include:

1. Lower head room required which does away with the necessity of additional excavation.
2. Condensation return troubles eliminated.
3. Hot water available at all hours.
4. Automatic temperature control usually not necessary.

Typical below-the-water line ratings for standard Type K heating elements are included in the table at the right.

TABLE Q

Gallons Per Hour Ratings

BOILER WATER TEMPERATURE	212°F.		200°F.		180°F.	
SERVICE WATER TEMPERATURE RANGE	40°–140°F.	50°–150°F.	40°–140°F.	50°–150°F.	40°–140°F.	50°–150°F.
WHITLOCK HEATING ELEMENT SIZE						
H-0	72	65	64	57	49	41
H-1	108	97	95	84	73	62
H-2	144	130	127	113	98	83
H-3	180	162	158	141	122	103
H-4	217	195	191	170	147	124
H-5	252	227	222	198	171	145
H-6	289	260	255	226	196	166
H-7	361	325	318	282	245	207
H-8	390	351	343	305	265	224
H-9	433	390	382	339	294	249
H-10	505	455	445	396	343	290
H-11	577	520	509	452	392	332
H-12	650	585	572	508	441	373
H-13	722	650	637	566	488	414
H-14	903	812	794	707	612	518
H-15	1082	975	955	848	735	622

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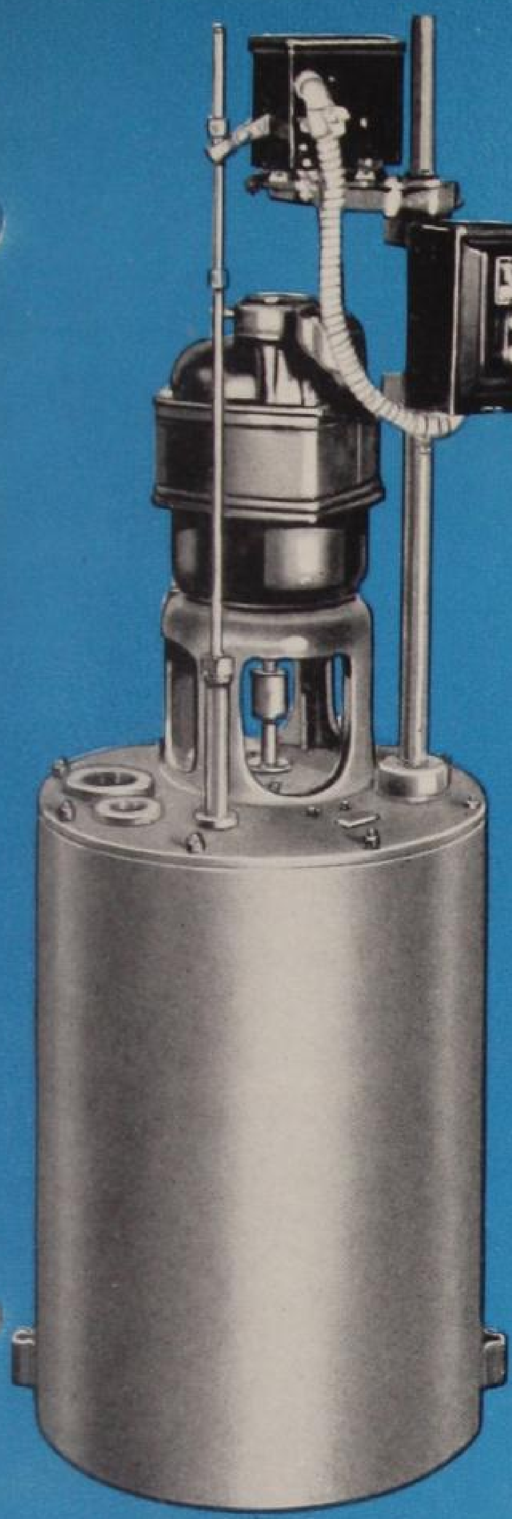

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- ★ Designed to prevent vapor binding and to handle condensation at high temperatures.
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The Darling VC Pump is designed and built for long service under the exacting conditions required for returning condensate from heating systems and process steam equipment to boiler or hot well. The Receiver may be installed on the floor or in a pit for returns from above or below the floor level. A product of over 60 years' experience in pump design and manufacture by Darling Brothers Limited.

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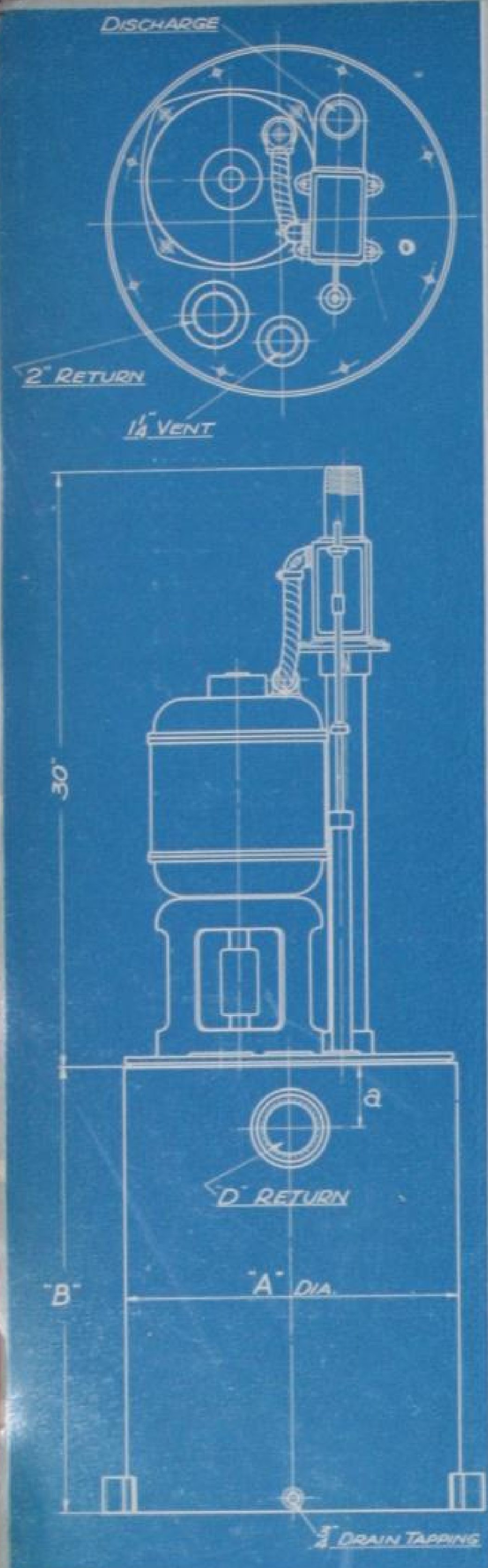

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Type VC

Vertical Condensation Return Pumps

DIMENSIONS • CAPACITIES • RATINGS

CAPACITY Sq. Ft. E.D.R.	CAPACITY U.S. Gals. per Min.	Discharge Pressure Lbs. per Sq. In.	Symbol	*60 CYCLES—1750 R.P.M. Motor H.P.	*60 CYCLES—1750 R.P.M. RECEIVER Diam. Ins. "A"	*60 CYCLES—1750 R.P.M. RECEIVER Height Ins. "B"	*60 CYCLES—1750 R.P.M. Shipping Wt. Lbs.	*25 CYCLES—1450 R.P.M. Motor H.P.	*25 CYCLES—1450 R.P.M. RECEIVER Diam. Ins. "A"	*25 CYCLES—1450 R.P.M. RECEIVER Height Ins. "B"	*25 CYCLES—1450 R.P.M. Shipping Wt. Lbs.	Size Discharge Ins.	Size Inlet "D" Ins.	Dimension "a" Ins.
4,000	6	10	4-V-10	⅓	18	18	300	⅓	18	18	320	1	2	3⅛
		15	4-V-15	⅓	18	18	300	⅓	18	18	320	1	2	3⅛
		20	4-V-20	½	18	18	320	½	18	18	340	1	2	3⅛
		25	4-V-25	¾	18	18	360	¾	26	18	390	1	2	3⅛
		30	4-V-30	1	18	18	410	1	26	18	450	1	2	3⅛
6,000	9	10	6-V-10	⅓	18	18	300	⅓	18	18	320	1	2	3⅛
		15	6-V-15	⅓	18	18	300	½	18	18	320	1	2	3⅛
		20	6-V-20	½	18	18	320	½	18	18	340	1	2	3⅛
		25	6-V-25	¾	18	18	360	¾	26	18	390	1	2	3⅛
		30	6-V-30	1	18	18	410	1	26	18	450	1	2	3⅛
8,000	12	10	8-V-10	⅓	20	24	310	⅓	20	24	330	1	2	3⅛
		15	8-V-15	½	20	24	330	½	20	24	350	1	2	3⅛
		20	8-V-20	½	20	24	330	½	20	24	350	1	2	3⅛
		25	8-V-25	¾	20	24	370	¾	26	18	400	1	2	3⅛
		30	8-V-30	1	20	24	420	1	26	18	460	1	2	3⅛
10,000	15	10	10-V-10	⅓	20	24	310	⅓	20	24	330	1¼	2½	3¼
		15	10-V-15	½	20	24	330	½	20	24	350	1	2½	3¼
		20	10-V-20	½	20	24	330	¾	20	24	400	1	2½	3¼
		25	10-V-25	¾	20	24	370	¾	26	18	400	1	2½	3¼
		30	10-V-30	1	20	24	420	1	26	18	460	1	2½	3¼
15,000	22½	10	15-V-10	½	24	24	340	⅓	26	24	360	1¼	3	3¾
		15	15-V-15	½	24	24	340	¾	26	24	410	1¼	3	3¾
		20	15-V-20	¾	24	24	380	¾	26	24	410	1¼	3	3¾
		25	15-V-25	1	24	24	430	1	26	24	470	1¼	3	3¾
		30	15-V-30	1½	24	24	500	1½	26	24	560	1	3	3¾
20,000	30	10	20-V-10	½	24	24	340	½	26	24	360	1¼	3	3¾
		15	20-V-15	¾	24	24	380	¾	26	24	410	1¼	3	3¾
		20	20-V-20	1	24	24	430	1	26	24	410	1¼	3	3¾
		25	20-V-25	1	24	24	430	1	26	24	470	1¼	3	3¾
		30	20-V-30	1½	24	24	500	1½	26	24	560	1¼	3	3¾
25,000	37½	10	25-V-10	½	24	36	420	½	26	36	440	1¼	4	4¼
		15	25-V-15	¾	24	36	460	¾	26	36	490	1¼	4	4¼
		20	25-V-20	1	24	36	510	1	26	36	550	1¼	4	4¼
		25	25-V-25	1½	24	36	580	1½	26	36	640	1¼	4	4¼
		30	25-V-30	1½	24	36	580	1½	26	36	640	1¼	4	4¼
30,000	45	10	30-V-10	½	24	36	420	½	26	36	440	1½	4	4¼
		15	30-V-15	¾	24	36	460	¾	26	36	490	1¼	4	4¼
		20	30-V-20	1	24	36	510	1	26	36	550	1¼	4	4¼
		25	30-V-25	1½	24	36	580	1½	26	36	640	1¼	4	4¼
		30	30-V-30	1½	24	36	580	1½	26	36	640	1¼	4	4¼

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It has a universal application, within its range of capacities, to horizontal or vertical pump installations. It is designed for maximum efficiency and long life in returning condensate to boiler, and as a condensate transfer unit from all types of heating and process equipment. Duplex Pump Units are available.

The rectangular cast iron receiver, of novel design, occupies the minimum area of usable floor space and can be installed at floor level or in a pit 14″ deep with the return line 3¼″ below the floor. This type of installation permits the running of low level pipe lines and will avoid damage by flooding, as the motor and electrical controls are above floor level.

While the standard unit is operated by a ⅓ H.P., 110/220 volt, 60 cycle, single phase motor, Polyphase motors can be supplied.

The "UNICON" is a complete factory assembled unit ready for connection to return, vent, and discharge pipe lines, and is wired between motor and switch, ready to receive electric supply. "UNICON" Condensate Units are given rigid capacity, pressure, and horsepower tests before shipment.

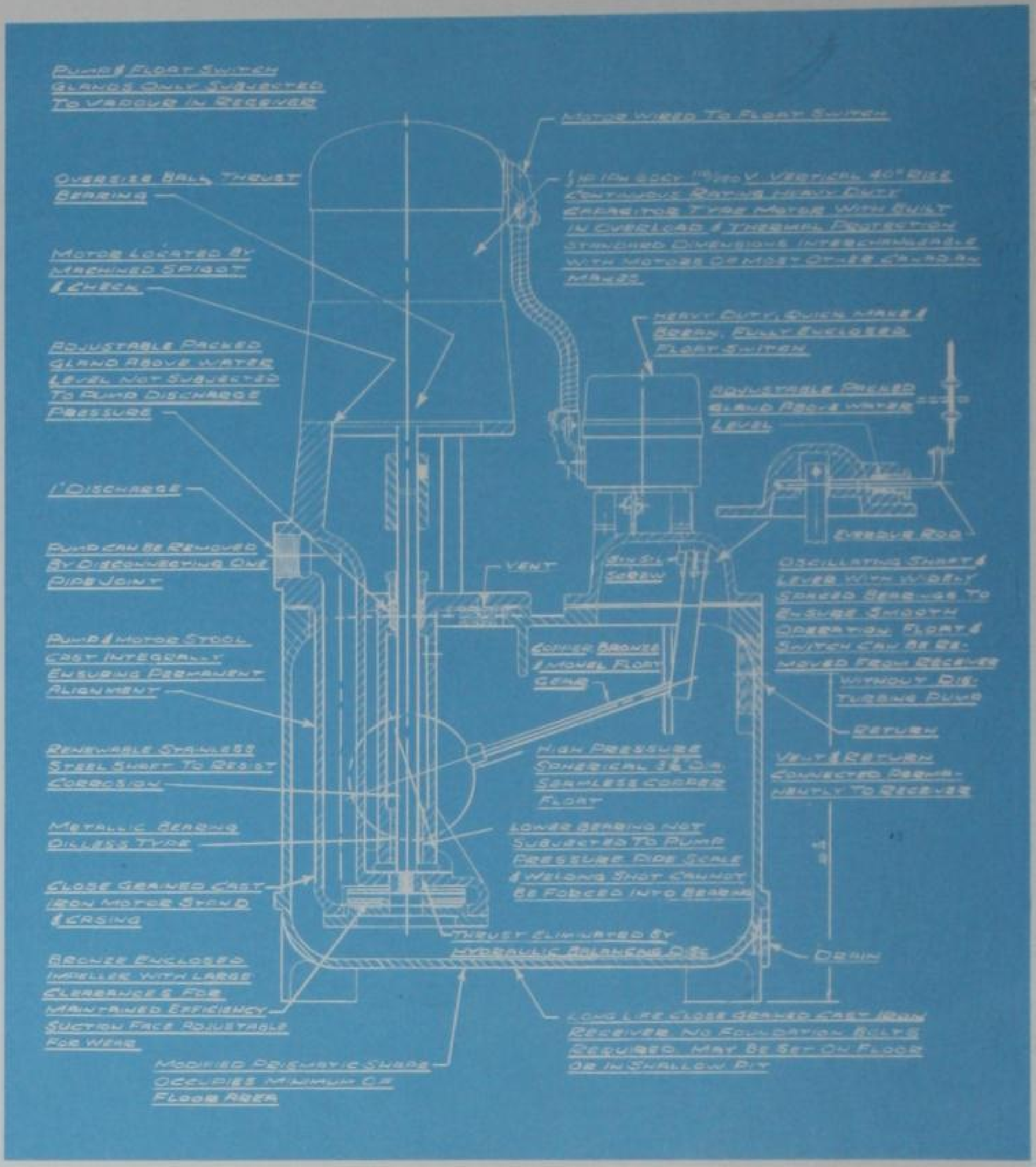
Condensate Pump and Receiver Unit

Typical Specification

Supply and install where indicated on plans__________ DARLING No.__________ "UNICON" Condensate Pump & Receiver Unit(s). Pump to be of centrifugal type having volute casing, column, elbow discharge pipe and motor stool cast integrally to insure correct alignment.

Pump to be fitted with machined bronze enclosed impellor, hydraulically balanced, secured to threaded stainless steel shaft. Shaft to be fitted with gland and follower at receiver cover. Lower submerged shaft bearing shall be of the Graphite type, requiring no lubrication and shall not be subjected to pump pressure.

Pump shall be operated by ⅓ H.P., 3500 R.P.M., 110/220-volt, 60-cycle, single-phase Motor of a type readily interchangeable among Canadian manufacturers. Motor fitted with built-in thermal overload protection. Motor shall be controlled by heavy-duty two-pole float switch actuated by a 3¾″ dia. seamless copper float. All working parts of control shall be of Everdur, copper or bronze. Pump and Motor unit shall be mounted in cast iron rectangular receiver with rounded corners.



Rating Table Class "U"

UNIT No.	SQ. FT. EDR	RECEIVER CAPACITY U.S. GALS.	PUMP CAPACITY U.S. GPM	PUMP DISCHARGE LBS. SQ. IN.	H.P. MOTOR	DIMENSIONS						WEIGHT
						W	L	H	VENT	RET	PUMP DISCH.	
320 U	3,000	6	4½	20	⅓	11¾″	16½″	26½″	1″	1½″	1″	125#
620 U	6,000	9	9	20	⅓	13″	19″	26½″	1¼″	2″	1″	152#
1020 U	10,000	15	15	20	⅓	17″	27″	26½″	1¼″	2″	1″	222#
1020 U DUPLEX	10,000	15	15	20	⅓	17″	27″	26½″	1¼″	2″	1″	284#

Since 1888

DARLING BROTHERS LIMITED 140 PRINCE STREET, MONTREAL, CANADA

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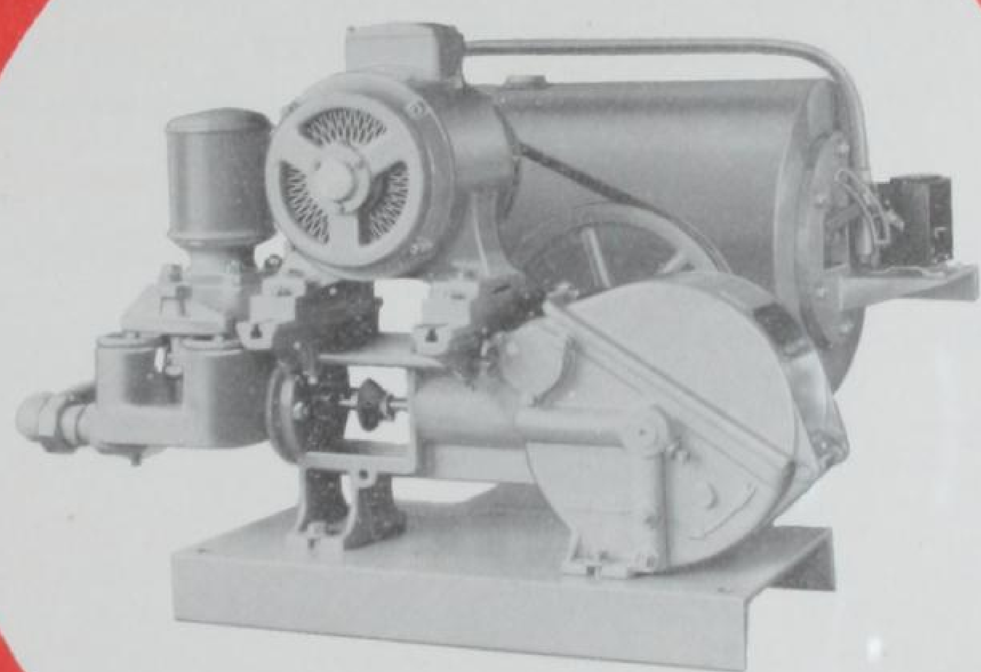
BULLETIN No. 47-B

Deming-Darling

ELECTRIC CONDENSATION RETURN PUMPS

TYPE "P C"



Deming-Darling Condensation Return Units, as illustrated are suitable for Plants with Boilers carrying up to 150 lbs., pressure. The illustration shows one of the larger units.

Darling Brothers Limited

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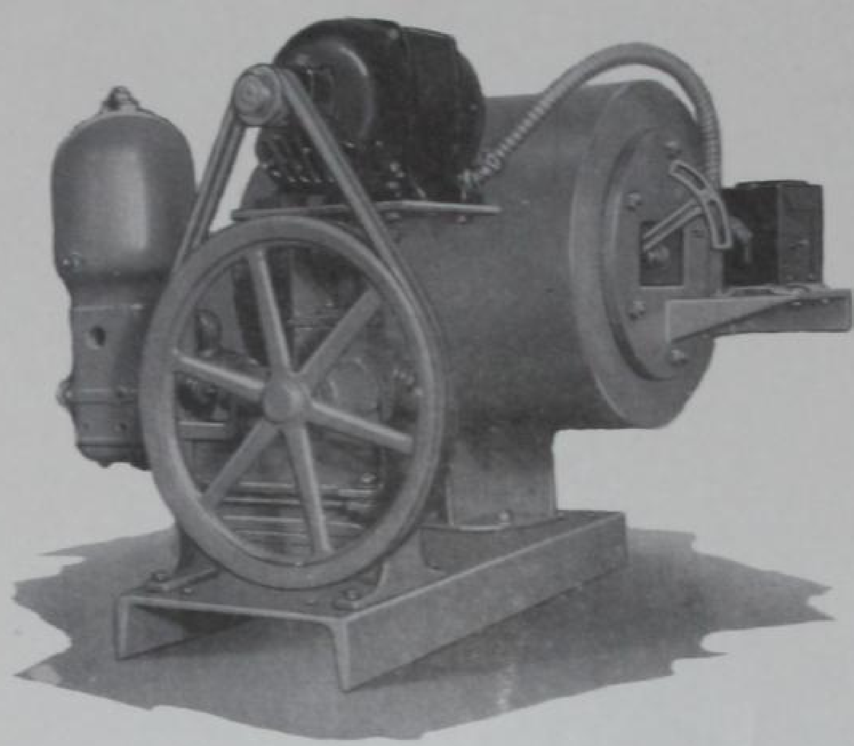


Deming-Darling type "PC" Electric Condensation Return Units are suitable for Plants with Boilers carrying up to 150 lbs., pressure. The illustration shows one of the smaller units.

The Deming-Darling type "P.C." Electric Condensation unit is self-contained and mounted on suitable channel iron or cast iron base, and is used for returning condensation from Heating Systems and other Process work, to high pressure boilers carrying steam pressures up to 150 lbs. While it is quite evident that a steam driven unit is capable of doing the same work, there is this advantage, that in the event of the steam pressure being lowered at night or on week ends, the electric unit will be more dependable and positive in operation. Large economies are obtained by returning hot condensate to the boiler. Units for pressures in excess of 150 lbs. can be furnished.

Pump.—This is a horizontal double-acting "Oil-Rite" Deming-Darling Pump, of the splash lubricated type, equipped with Timken roller bearings, helical cut gears and stainless steel shaft, stainless steel piston rod, special packed piston, stuffing box packing and valves, all designed for hot water service, and all working parts are easily accessible.

Drive.—This unit is driven by a V-belt drive of ample capacity, making a smooth running unit.

Receiver.—The receiver is of welded steel and is supported on a steel leg, which is bolted to the solid base. Suitable openings are provided on each size receiver to suit its capacity. All fastenings are made with through bolts or studs. Suction piping from receiver to pump is provided. Gauge glass and fittings are not included with this outfit, but may be supplied at extra cost if required.

Automatic Control Gear.—Mounted on the end cover of the receiver is the float switch, which is enclosed and has quick make and break contact, with two poles for single phase, and three poles for three phase motors. The switch is actuated by an extra heavy seamless copper float, through bronze links and rocking shaft. The rocking shaft passes through a screwed bronze stuffing box. Changes in stop and start water levels are easily made. Electric wiring from motor to float switch is provided but main line switch is not included.

Motors.—Standard makes of motors only are used. Single phase motors are of the Repulsion-induction type. Direct current motors are Compound Wound. Polyphase motors are of the Squirrel cage type. The temperature rise of all above motors is 40 degrees C. at full load, continuous rating. Motors are of the ball bearing type. While the motor cannot be over-loaded by the pump, mechanical overloads such as the stuffing box being too tightly packed, or electrical conditions such as low or high voltage or open phase might arise. To protect the motor against such conditions, we recommend the use of some kind of time limit fuse or other overload protection. Suitable protective devices can be supplied as an extra.

Operation.—The condensation returns enter the receiver at the top. When it reaches a predetermined height, determined by setting of water level adjustment, the float closes the switch, starting pump and motor, and when receiver is nearly empty the float opens the switch and stops the pump and motor.

Testing.—All Darling pumps are tested for capacity, head and horsepower used. Our testing department is equipped with all necessary apparatus to make accurate tests on all outfits built by us. Electric current of different frequencies and voltages is available so that all units can be run with their own motors. Customer may witness test, if desired.

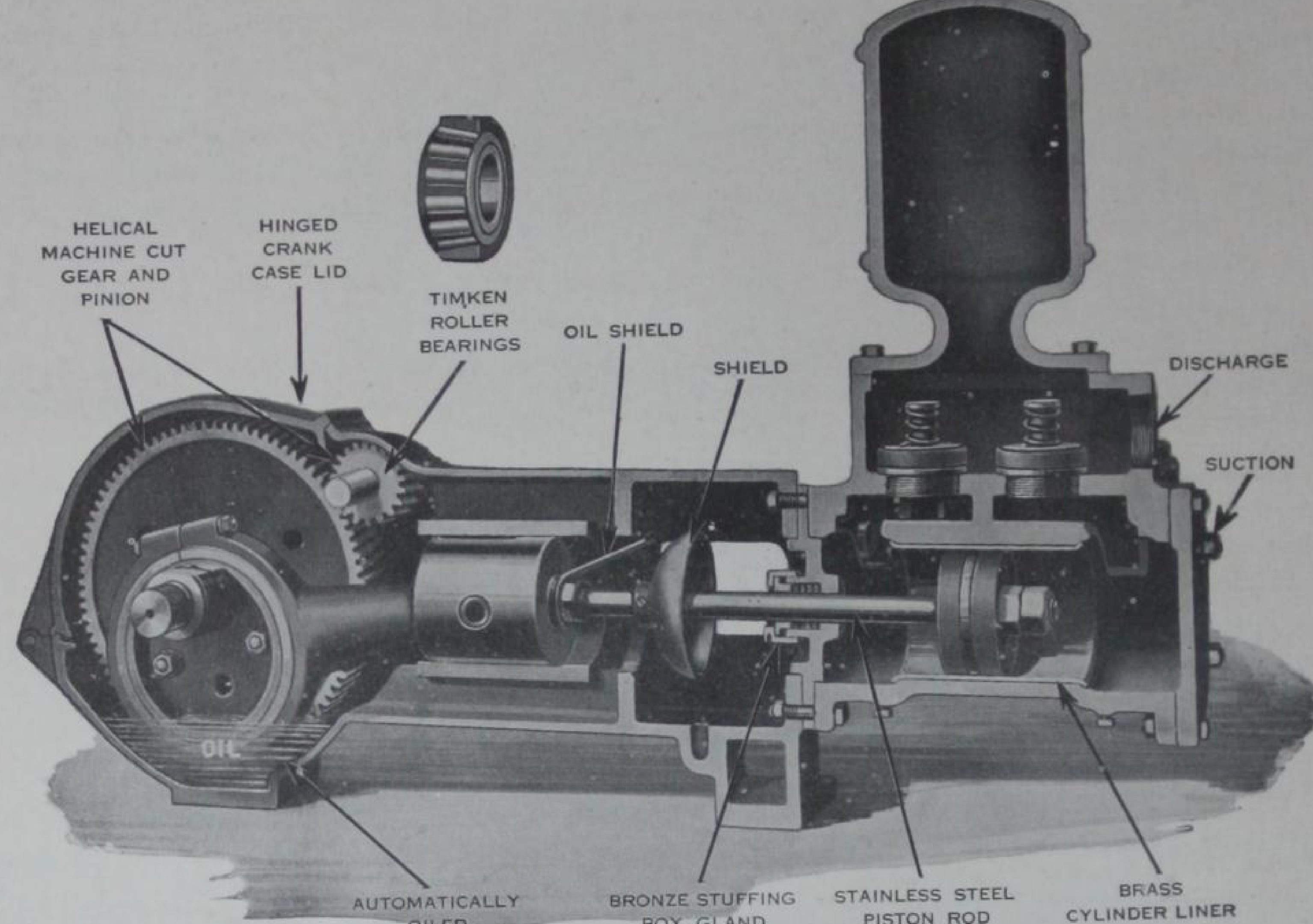
Guarantee.—We guarantee this outfit against electrical and mechanical defects for the period of one year. Unless some form of suitable protection is supplied our guarantee does not apply to motor.

RATINGS AND DIMENSIONS

Applicable to both 25 and 60 cycle 1450 and 1750 R.P.M. Motors

Size No.	Capacity U.S. G.P.M.	Boiler H.P.	Sq. Ft. Direct Radiation	Working Pressure Pounds	Diam. Pump Cylinder, and Stroke	Pump Figure No.	Size Disch. Inches	H.P. Motor Furnished	Size Return Inlet	Receiver Diam. and Length	Floor Space L.W.	Approx. Weight
1 PC 50	2	10	1000	50	1⅛"x1½"	1890	¾"	1/6	2"	15"x18"	24x30	300
1 PC 75	2	10	1000	75	1⅛"x1½"	1890	¾"	¼	2"	15"x18"	24x30	310
2 PC 50	4	20	2000	50	1½"x1½"	1890	¾"	¼	2"	15"x18"	24x30	310
2 PC 75	4	20	2000	75	1½"x1½"	1890	¾"	⅓	2"	15"x18"	24x30	320
4 PC 50	6	40	4000	50	2½"x3"	1809	1¼"	⅓	2"	17"x20"	33x33	500
4 PC 75	6	40	4000	75	2½"x3"	1809	1¼"	½	2"	17"x20"	33x33	510
4 PC 100	6	40	4000	100	2½"x3"	1809	1¼"	¾	2"	17"x20"	33x33	520
4 PC 150	6	40	4000	150	2¼"x3½"	1809 HP	1¼"	1	2"	17"x20"	39x35	710
6 PC 50	9	60	6000	50	2½"x3"	1809	1¼"	½	2"	17"x20"	33x33	510
6 PC 75	9	60	6000	75	2½"x3"	1809	1¼"	¾	2"	17"x20"	33x33	520
6 PC 100	9	60	6000	100	2½"x3"	1809	1¼"	1	2"	17"x20"	33x33	530
6 PC 150	9	60	6000	150	2¼"x3½"	1809 HP	1¼"	1	2"	17"x20"	39x35	710
8 PC 50	12	80	8000	50	3" x3½"	1809	1½"	¾	2½"	18"x24"	39x38	700
8 PC 75	12	80	8000	75	3" x3½"	1809	1½"	1	2½"	18"x24"	39x38	710
8 PC 100	12	80	8000	100	3" x3½"	1809	1½"	1½	2½"	18"x24"	39x38	720
8 PC 150	12	80	8000	150	3" x4½"	1809 HP	1½"	2	2½"	18"x24"	48x42	980
10 PC 50	15	100	10000	50	3" x3½"	1809	1½"	1	2½"	18"x24"	39x38	710
10 PC 75	15	100	10000	75	3" x3½"	1809	1½"	1½	2½"	18"x24"	39x38	720
10 PC 100	15	100	10000	100	3" x3½"	1809	1½"	2	2½"	18"x24"	39x38	750
10 PC 150	15	100	10000	150	3" x4½"	1809 HP	1½"	3	2½"	18"x24"	48x42	1000
12 PC 50	18	120	12000	50	3" x4½"	1809 HP	1½"	1	3"	18"x36"	48x42	980
12 PC 75	18	120	12000	75	3" x4½"	1809 HP	1½"	1½	3"	18"x36"	48x42	1000
12 PC 100	18	120	12000	100	3" x4½"	1809 HP	1½"	2	3"	18"x36"	48x42	1010
12 PC 150	18	120	12000	150	3" x4½"	1809 HP	1½"	3	3"	18"x36"	48x42	1020
15 PC 50	21½	150	15000	50	4" x4½"	1809	2"	1½	3"	18"x36"	48x42	1000
15 PC 75	21½	150	15000	75	4" x4½"	1809	2"	3	3"	18"x36"	48x42	1020
15 PC 100	21½	150	15000	100	4" x4½"	1809	2"	5	3"	18"x36"	70x42	1040
15 PC 150	21½	150	15000	150	3" x5"	1896	2"	5	3"	18"x36"	74x45	1350
20 PC 50	30	200	20000	50	4" x4½"	1809	2"	2	3"	18"x36"	48x42	1010
20 PC 75	30	200	20000	75	4" x4½"	1809	2"	3	3"	18"x36"	48x42	1020
20 PC 100	30	200	20000	100	4" x4½"	1809	2"	5	3"	18"x36"	70x42	1040
20 PC 150	30	200	20000	150	4" x5"	1896	2"	5	3"	18"x36"	74x45	1400

Pressure given above is at the pump. Allowance must be made for height of boiler water line and friction of pipe and fittings between boiler and pump.



Sectional illustration of Deming-Darling "Oil-Rite" Horizontal Piston Pump, with names of principal parts as used on the larger units.

TYPICAL FORM OF ENGINEER'S SPECIFICATION FOR DEMING-DARLING ELECTRIC CONDENSATION RETURN PUMP

Furnish and instal where indicated on plans..........type "P.C." Deming-Darling Electric Condensation Return Pump and Receiver for automatically returning condensate to boiler. Pump to have a capacity of..........Imperial Gallons per minute against a pressure of............... pounds per square inch at pump discharge. Receiver to be suitable to handle..............square feet direct radiation. Receiver to be..........X..........with electric service for............ Current............Phase..........Cycles.

The unit shall consist of one Deming-Darling Pump of suitable size with electric motor, "V" belt drive and one receiver made of heavy steel plate. Pump, motor and receiver to be mounted on one base. All piping connections between pump and receiver and wiring connections between control switch on receiver head and motor, to be made by Darling Brothers Limited.

Pump to be single cylinder horizontal double acting power piston pump, of suitable size, entirely enclosed and automatically oiled, and fitted with Timken Roller Bearings, and stainless steel piston rod. Special packed piston, stuffing box packing and pump valves are to be suitable for hot water service. A "V" Belt Drive of ample capacity to operate the pump, to be provided.

Control.—Mounted on receiver cover, consisting of a totally enclosed Butt contact float switch actuated by an extra heavy seamless copper float. The rotating float shaft to run through a screwed bronze stuffing box. Float switch to automatically start motor when receiver is full, stopping it when water has been pumped out. An adjustment to be provided so that start and stop water levels can be changed.

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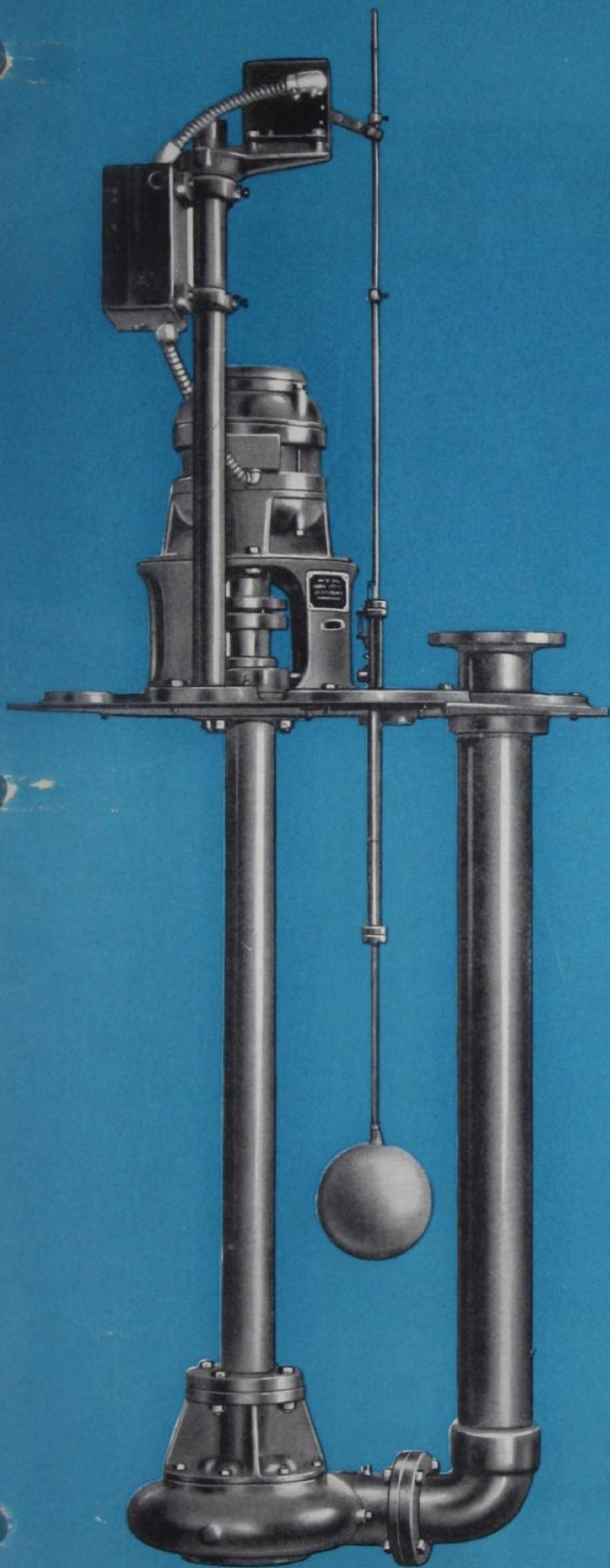

Yeomans Darling

MANUAL OF
Heavy Duty
Automatic Electric
VERTICAL CENTRIFUGAL

PUMPS

Type YS

For Unscreened Sewage, Thick Liquids and Liquids Containing Solids.

Type YB

For Waste, Flood Water and General Drainage Purposes.

★

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DARLING BROTHERS

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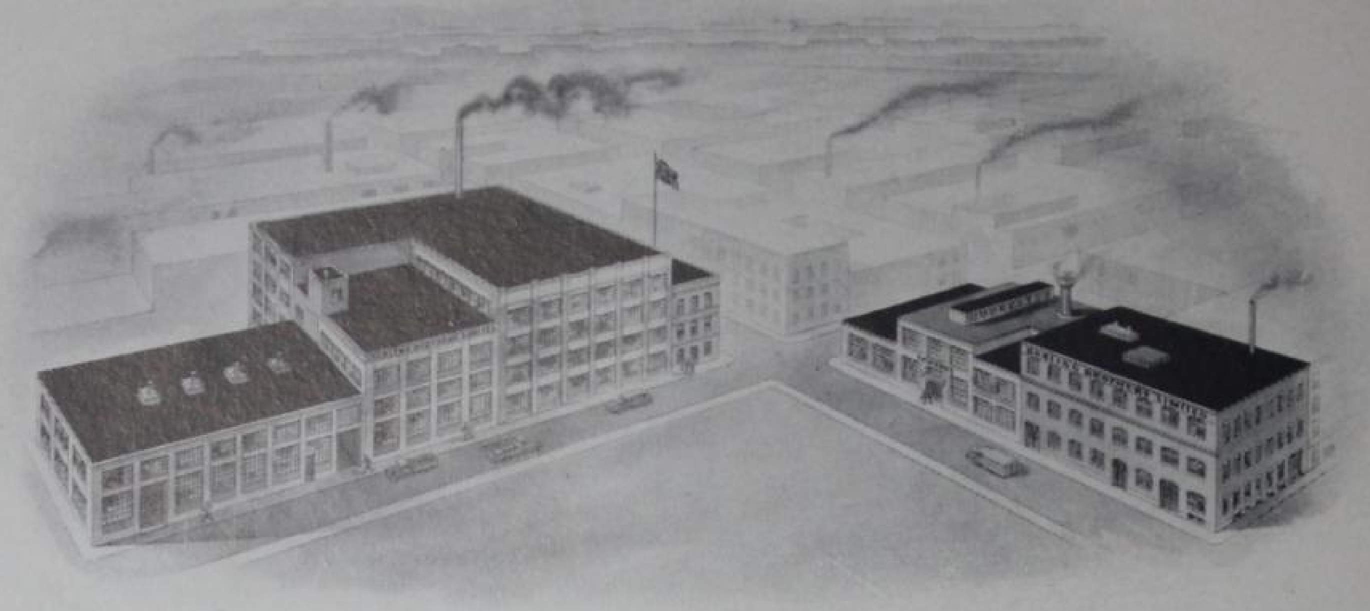


Foreword

Experience and Policy Nearly a half century of experience and development by Yeomans Brothers and Darling Brothers in the design, manufacture and application of Bilge and Sewage Pumps, has resulted in products of the highest efficiencies, a fact attested by the repeated selection of Yeomans Darling Equipment by the most exacting engineers. There is no worthier tribute to the knowledge and skill of our designing engineers and to the craft of the artisans in our foundry and manufacturing plant. Behind the name of Yeomans Darling is an unimpeachable policy for quality of workmanship and performance, a first charge upon the engineering skill and resources of an organization whose products are known to engineers from the Atlantic to the Pacific.

Manufacturing Facilities Yeomans Darling Bilge and Sewage Pumps are manufactured in the Montreal Plant of Darling Brothers Limited, facilitating replacements should the necessity arise during the life of the pump. Complete records are kept for all pumps sold, thus engineering details and test data are always available.

Engineering Services Although the purpose of this manual is to present in concise form essential data on Yeomans-Darling Bilge and Sewage Pumps, and to indicate their field of application, no attempt is made to present a technical treatise on pump characteristics, or other detailed engineering information bearing on the development or manufacture of the pumps. Long experience has proven that the pump user's interest can best be served if he submits detailed information on his proposed application and permits our engineers to recommend a pump which will give the most efficient and reliable service.

Guarantee All goods supplied by us are subject to our guarantee, which is limited to furnishing F.O.B. our works such parts as prove defective in material and workmanship within one year from date of shipment. Our organization is comprised today of men who adhere to those well planned and soundly conceived policies of the founders, men with long years of practical experience in their industry, men with personal interest as long-term employees in the constant development and improvement of Yeomans-Darling products. These principles and traditions make this guarantee a firm obligation.

Yeomans Darling

Index

The Yeomans Darling Automatic Electr c

Control –
Enclosed heavy duty float operated pilot switch and magnetic starter mounted on pipe support; actuated by heavy copper float, guided brass rod and adjustable stops.

Coupling –
Safety type pin and rubber buffer coupling keyed to shaft.

Top Bearing –
Oil immersed self-aligning ball thrust bearing; renewable bronze bushing.

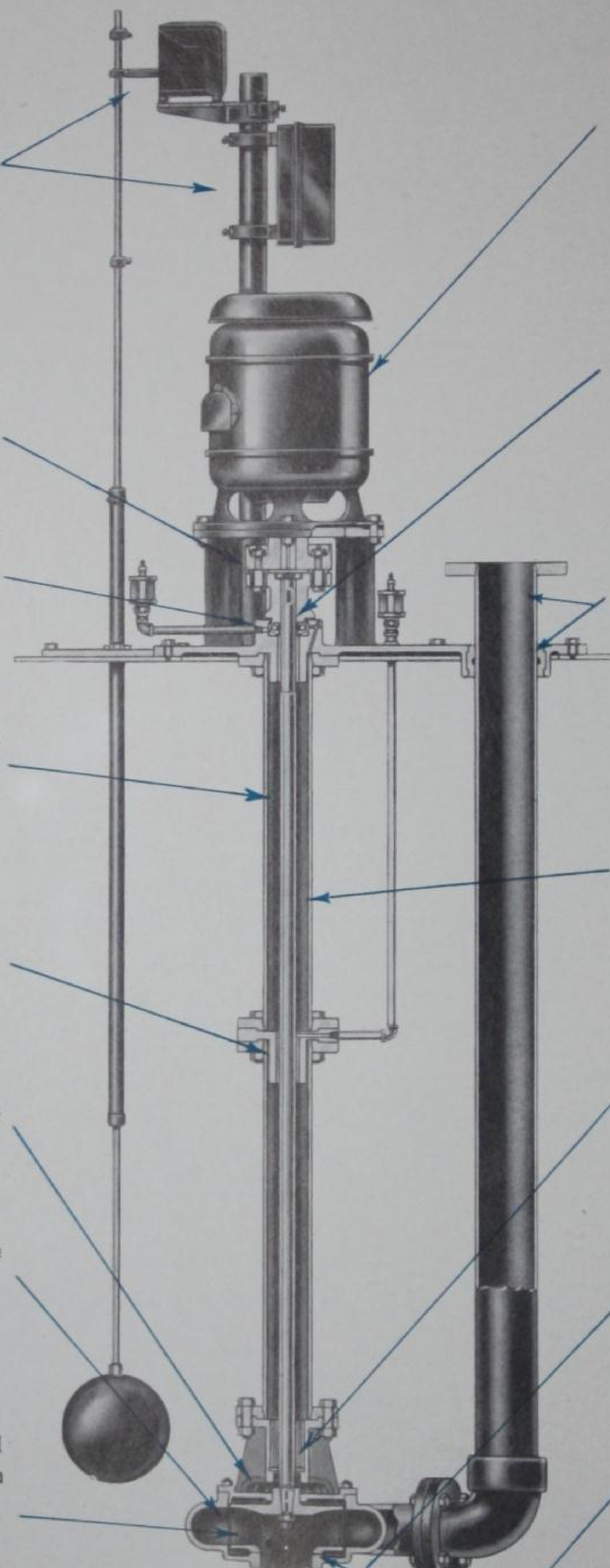
Large Shaft –
Large ground steel shaft runs below first critical pump speed.

Shaft Bearing –
Renewable bronze bushings.

Trash Guard –
Prevents stringy material from binding shaft.

Pump Casing –
Special design casing of close grained cast iron.

Impeller –
Balanced two-port enclosed bronze impeller enables small pumps to handle a minimum of $2\frac{1}{2}$ inch diameter solids.



Motor –
Vertical ball bearing type motor, with drip cover, spigotted on integrally cast combination stool, base and pump bearing.

Thrust Bearing –
Weight of rotating element and pump thrust transmitted through shaft nut to oil immersed ball thrust bearing.

Discharge Pipe –
Overall efficiency increased by large diameter discharge pipe, which is calked in cover to eliminate strains and misalignment.

Suspension Pipe –
Rigid shaft housing of heavy steel with cast iron spigoted flanges screwed on and refaced in lathe.

Pump Bearing –
Renewable oil immersed bronze bearing protected from water by self-adjusting seal ring.

Wear Adjustment –
Impeller clearance adjustable axially by adjusting nut to compensate for wear.

Casing Easily Removed –
Bolted flanged joint on discharge pipe facilitates removal of casing.

TYPE YDS SEWAGE PUMP

Design features shown above apply also to Bilge Pump excepting impeller, impeller wear adjustment and pump casing.

FEATURES OF

Heavy Duty Vertical Centrifugal Pumps

Thrust Bearing Section

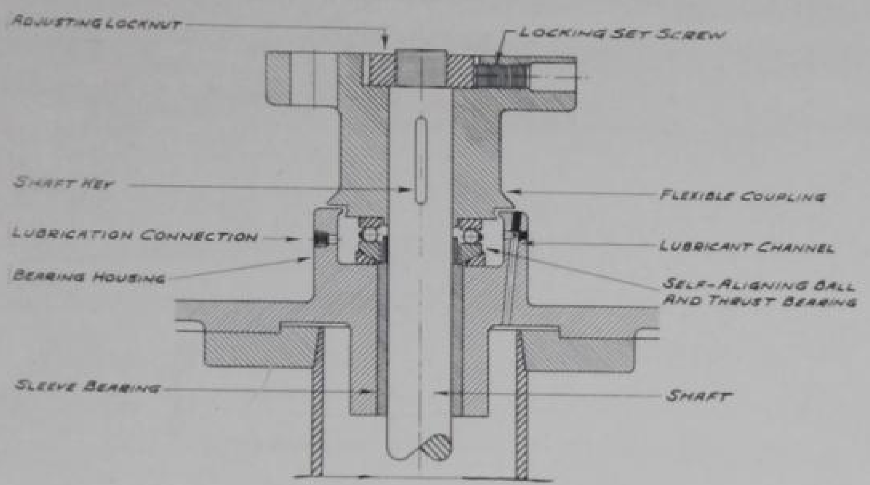


Fig. 1

Thrust loads are handled by self-aligning ball bearing located above cover plate away from grit and moisture.

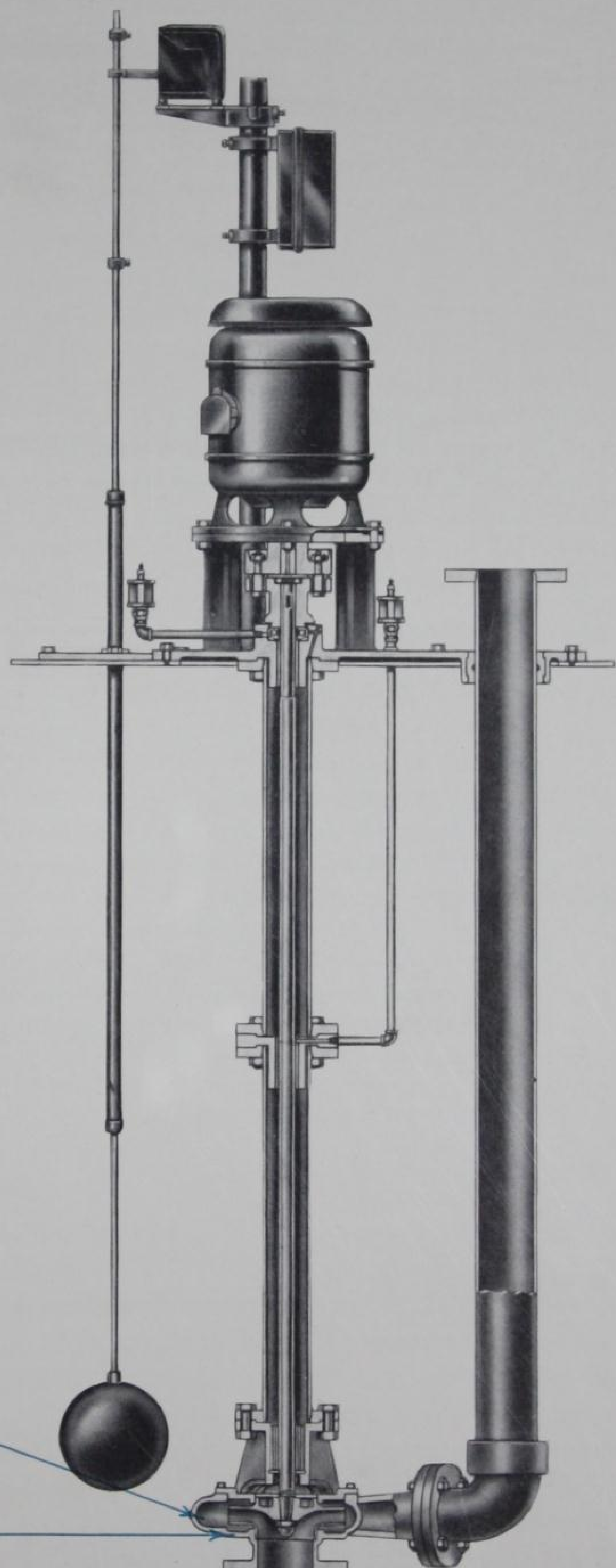
ADDITIONAL FEATURES OF SEWAGE AND BILGE PUMPS

Assembly — All component parts attached by through bolts or studs with nuts and alignment secured by machined spigots.

Bearing Wear Reduced—Overhung impeller design and oil immersed bearing reduces bearing wear.

Shaft Alignment — Motor aligned by spigot on integrally cast combination stool, base and pump bearing. This maintains alignment of shafts.

Lubricant Protection — Overhung impeller design with combination water and oil seal ring prevents loss or contamination of shaft lubricant.



Pump Casing — Heavy close grained cost iron, streamlined for flow, rigidly attached by flanged joint to shaft housing and discharge pipe.

Impeller — Patterned after our well known Class D Horizontal Pump impeller, with water passages file finished to increase efficiency.

For Other Construction and Equipment Features, see page 7.

TYPE YDB BILGE PUMP

Factors in Selecting Pumps

Consider these Facts

The buyer of sewage or bilge pumps is primarily interested in getting rid of waste simply, efficiently and as economically as possible. The assumption that any pump will do the work is the wrong approach to pumping problems of this nature. Since two sets of conditions are seldom alike, each problem must receive careful consideration of all the contributing factors in order that a satisfactory installation may result. All too frequently trouble is caused by the installation of the wrong type of pump resulting in damage to property, equipment and unhealthy conditions. While experienced engineers are familiar with these problems we do not believe this manual would be complete without a review of the facts.

Manufacturer's Recommendation

Years of experience in the specification and design of sewage and bilge pumps by Yeomans Darling pump engineers has given us the knowledge and engineering skill to gain a most enviable reputation amongst architects and engineers throughout the Dominion. Like any other piece of equipment involving a multitude of variable factors there are many points to consider before a pump can be recommended. If these points are emphasized to the buyer and applied in the purchase of the equipment the transaction will result in long years of satisfactory service, barring accident or subsequent changed conditions.

Knowledge of Application

The reputation of the manufacturer, knowledge of the application and the capacity of the pump to pass large solids or handle waste efficiently, are important considerations in specifying a pump. Take, for instance, speed as related to operating head. In most cases abnormally high head conditions will require high speed motors for average sewage pump capacity, on the other hand, high speeds for low heads frequently result in a noisy pump and short life.

There is sometimes a tendency among specification writers to indicate that pumps passing 2" or even 1½" spheres will be accepted because of an offer of relatively high efficiency as compared with pumps passing larger solids, especially in the case of small capacity pumps operating on high heads. In order to obtain high efficiency in pumps of this type, it is essential that the entrance or eye and water passages of the impeller and casing be very much restricted, but with this design it is not possible to handle solids larger than 1½" or 2" in diameter. Therefore, where there is any chance that larger solids will be present it is necessary to sacrifice efficiency by designing the pump with larger water passages. In smaller passages rags and articles of clothing, invariably found in unscreened domestic sewage, are certain to cause stoppage.

The bore of a standard water closet is 2½" diameter, and that dimension may well be taken as the minimum water passage in any pump handling unscreened sewage. We strongly urge that unless screens which will intercept large rags and articles of clothing are provided ahead of the sewage pump, specifications require that the pump shall be capable of passing spheres not less than 2½" diameter.

Price Consideration

In specifying sewage pump speeds, if the selection is made on the slowest practical speed for the head condition there is assurance of good service, with the exception, perhaps, of very large pumping stations. The annual saving in power resulting from higher efficiency of the pumps passing smaller solids is not worth the labor, annoyance, inconvenience and unsanitary conditions incidental to frequent withdrawal of the pumping unit to clear the inlet or restricted water passages in the pumps. For added protection Duplex Pumps are recommended. See How to Select A Bildge or Sewage Pump, page 10.

Construction and Equipment

Sewage Pump

The Yeomans Darling Centrifugal Submerged Screenless Sewage Pump is furnished as a unit, the main parts consisting of the pump casing, impeller, shaft, suspension and discharge pipes, thrust bearing and flexible coupling, factory assembled on a baseplate with a sump cover, together with motor and automatic control equipment. Cast iron or steel basins and curb rings are available as optional equipment.

Pump casing is the screenless cast iron type equipped with a new and improved balanced two-port cast bronze impeller, the design permitting small pumps to handle solids with a minimum diameter of 2½ inches, larger units in proportion. The impeller is mounted on the tapered end of the shaft and secured in position by a fitted key, and aginst axial movement by a cap nut. The impeller clearance is adjustable to compensate for wear.

The pump is hung from the baseplate by a wrought iron suspension pipe enclosing the pump shaft, which runs well below the first critical speed. In addition the pump is supported by the discharge pipe extending upward from the pump through the baseplate. With duplex sets the pumps are hung from individual baseplates mounted on the main catch basin cover, so that one pump may be removed without disturbing the other.

Bilge Pump

The design and performance features of the Yeomans Darling Submerged Bilge Pump are the same as those of the Sewage Pump with the exception of the impeller, impeller wear adjustment and pump casing. The impeller is cast bronze, enclosed type, with water passages file finished and balanced and secured on the shaft by keyseated tapered bore and locknut. Our bilge pump impellers are made with a hydraulic balancing device to take care of axial thrust. The vanes of an efficient design developed in our hydraulic laboratory.

In all other respects the design and performance features described in this manual apply to both types of pumps.

Bearings

Weight of pump shaft, impeller and coupling is carried by a single self-aligning oil immersed ball thrust bearing mounted in a housing above the baseplate. A renewable self-lubricating bronze sleeve bearing running in an oil bath is located in the pump cover immediately above the impeller.

Pump & Bearing Assembly — Dry Pit Type

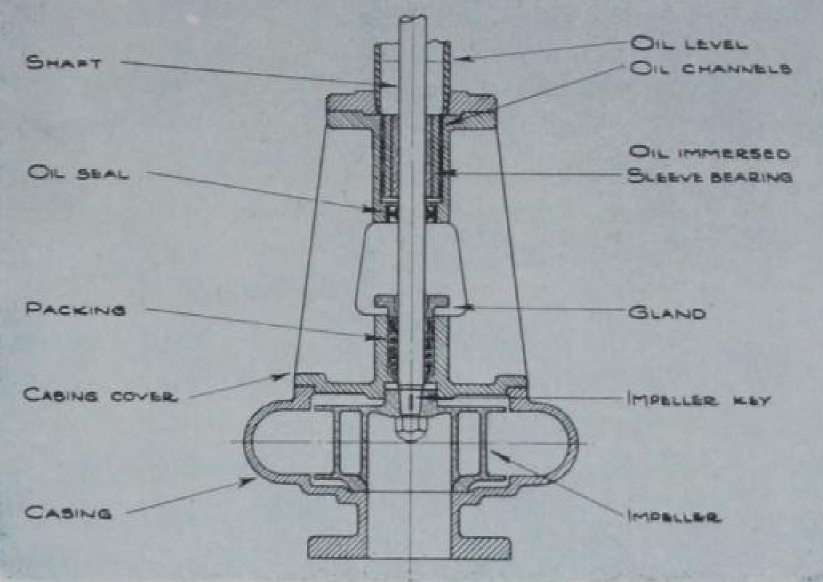


Fig. 2—The packing gland is bronze, split type, to protect the lower sleeve bearing from abrasives. The sealing ring is designed for water or grease; because of the balanced impeller design pressure on the packing box is low resulting in reduced wear.

Because any long unsupported shaft may whip and vibrate, intermediate guide bearings are provided on shafts for deep sumps. One intermediate guide bearing is furnished for basins over 6 feet and up to 12 feet deep, more for deeper sumps.

Motors

On our standard pump motors are vertical ball bearing type with drip covers and flanged base spigotted for correct alignment on pump base. Motors on our standard vertical pumps are built to NEMA specifications, thus should changes or servicing be necessary a motor of any standard Canadian manufacture of equivalent rating can be mounted on the motor stool. When increased capacity is required this can be accomplished in many cases by increasing the size of the impeller and the motor. The temperature rise of our motors is 40 Deg. C., continuous rating.

Easily Dismounted

Yeomans Darling Submerged Pumps are entirely independent of the sump and by disconnecting wiring and discharge pipe can be removed without disturbing sump cover or draining sump. As all the parts are spigotted removal is simplified without danger of misalignment on reassembly.

Yeomans-Darling Automatic Oil Economizer

Probably 99% of all vertical shaft centrifugal ejectors installed for pumping sewage and drainage are equipped with automatic start and stop control, and in many of these installations the ejector may be idle for long periods of reduced inflow, this being especially true of reserve units arranged to cut in automatically under peak conditions.

It is obvious that if the guide and thrust bearings of these ejectors are supplied with oil from the ordinary sight feed lubricator, the lubricant consumption will be continuous. This can be overcome by the use of oil economizer.

The Yeomans-Darling Oil Economizer supplies oil to bearings only when the ejector is running, and thus accomplishes the following results: Stops needless waste of oil; lessens danger of bearings running without oil; lessens frequency of filling oil container, cuts down maintenance and repairs.

The Economizer consists of a suitable lubricator of liberal capacity with individual adjustable sight feeds for all guide and thrust bearings requiring lubrication, the needle valve in the oil container is automatically opened and closed by a diaphram connected through copper tubing and piping to pump discharge. Pressure on the diaphram opens the oil valve when the ejector is running. The Economizer is ordinarily mounted on a flanged pipe support on sump cover or baseplate close to the motor.

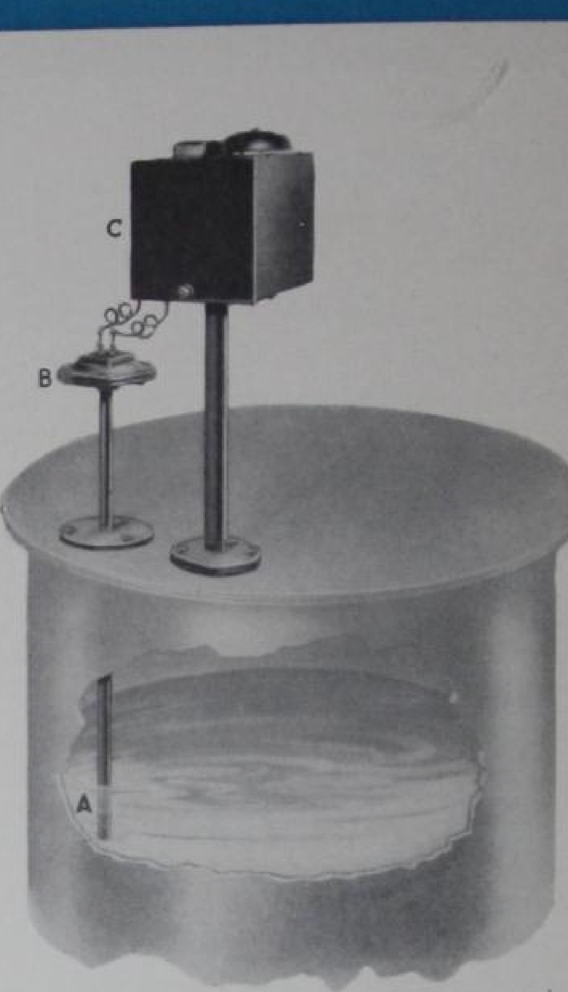


Fig. 3 — Automatic High Water Alarm.

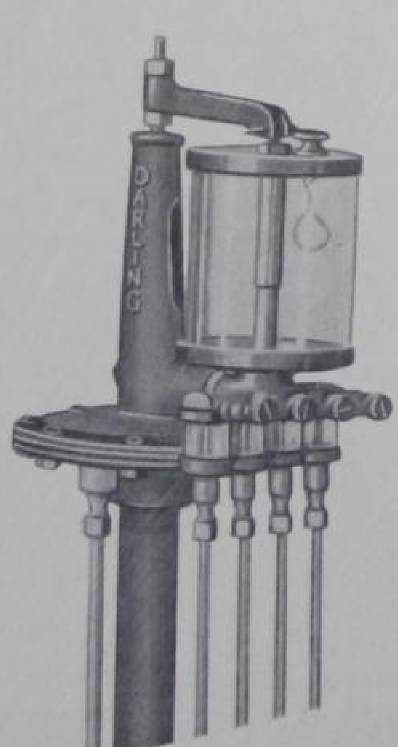


Fig. 4—Yeomans Darling Fully Automatic Oil Economizer.

High Water Alarm

In the event of power failure or inflow too great for the pump to handle, the Yeomans Darling high-water alarm, Fig. 3, rings a warning bell. It is mounted on top of the basin with an open tube extending down almost to the normal high water level. If the water rises above this point, the tube (A) is sealed and the increasing pressure compresses the air trapped within. This acts upon a sensitive diaphram (B) which in turn closes an electric circuit and rings the bell (C). The latter may be located at a distance from the pump if desired and may be operated by battery or from lighting circuit.

Flexible Shaft

Fig. 5 — Illustrates the Watson Spicer flexible needle-bearing shafting that handles misalignment to eight degrees, operates smoothly and without noise, cuts installation cost by minimizing framework and lining up, and eliminates the whipping, bearing failure and motor heating that misalignment causes. See drawing and application information on page 20.

Fig. 5—Automotive Type Flexible Shaft.

Sump Covers

The recommended method is to pour a concrete slab over the sump and install Cast Iron Curb Rings to take pump base and float openings. This method reduces required floor area to a minimum.

The sump can also be covered with a steel plate having suitable openings for motor base and float control. It can be grouted in for a gas tight installation obviating the use of a curb ring.

Minimum Floor Space

Due to compact design our pumps require little floor space, an important consideration where space is at a premium. The covers should be installed flush with the floor. See drawing and suggested minimum plate dimensions, Page 18.

Float Pipe

To protect the float from injury and interference from heavy inflow to basin, and from floating objects, a pipe to enclose the float along the line of float travel is recommended as a guarantee of longer life and greater ease of operation. This protective pipe is illustrated in Fig. 9 on page 14. In addition the float is protected by ribs to prevent abrasion.

Efficient Lubrication

All Yeomans Darling pumps are efficiently lubricated for long life with minimum wear. The weight of the rotating element is carried by a self-aligning ball thrust washer immersed in an oil bath. The overflow from this bath is led by gravity to the lower bearing by channels drilled in the motor baseplate.

The lower pump bearing is the oil immersed type fed by the drips from the upper thrust bearing. The oil is kept in the bearing by a dual seal ring, the outer part keeping the water out and the inner ring keeping the oil in.

For shaft spans greater than six feet, bronze lined intermediate bearings are used. The bearings are lubricated from the motor base level through tubing from the oiling device. All oil pipes are copper or brass held securely in position by clips.

Automatic Control

Yeomans-Darling pumps are controlled from the water levels in the sump by an automatic control device which may be either a float acuated switch or electrode type control. Either type of control device is mounted on steel support together with necessary magnetic motor starting equipment.

For Duplex Pumps all control devices can be mounted on a common control panel, as illustrated in Fig. 6. Starters and switches are set close to the motors which they control. A double-throw transfer switch interchanges float switches and motors. Wiring connections are simplified.

Automatic Alternation

In duplex sets, one unit will do most of the work unless service is alternated. To provide a simple and positive means for mechanically alternating the operation of two pumps in a duplex system, Yeomans Darling offer a mechanical alternator. It cuts in first one unit, then the other, and provides the additional function of starting the "second" pump when extra capacity under peak conditions is required. It resumes cyclic operation when the emergency passes. Wear in pumps is equalized without constant attention.

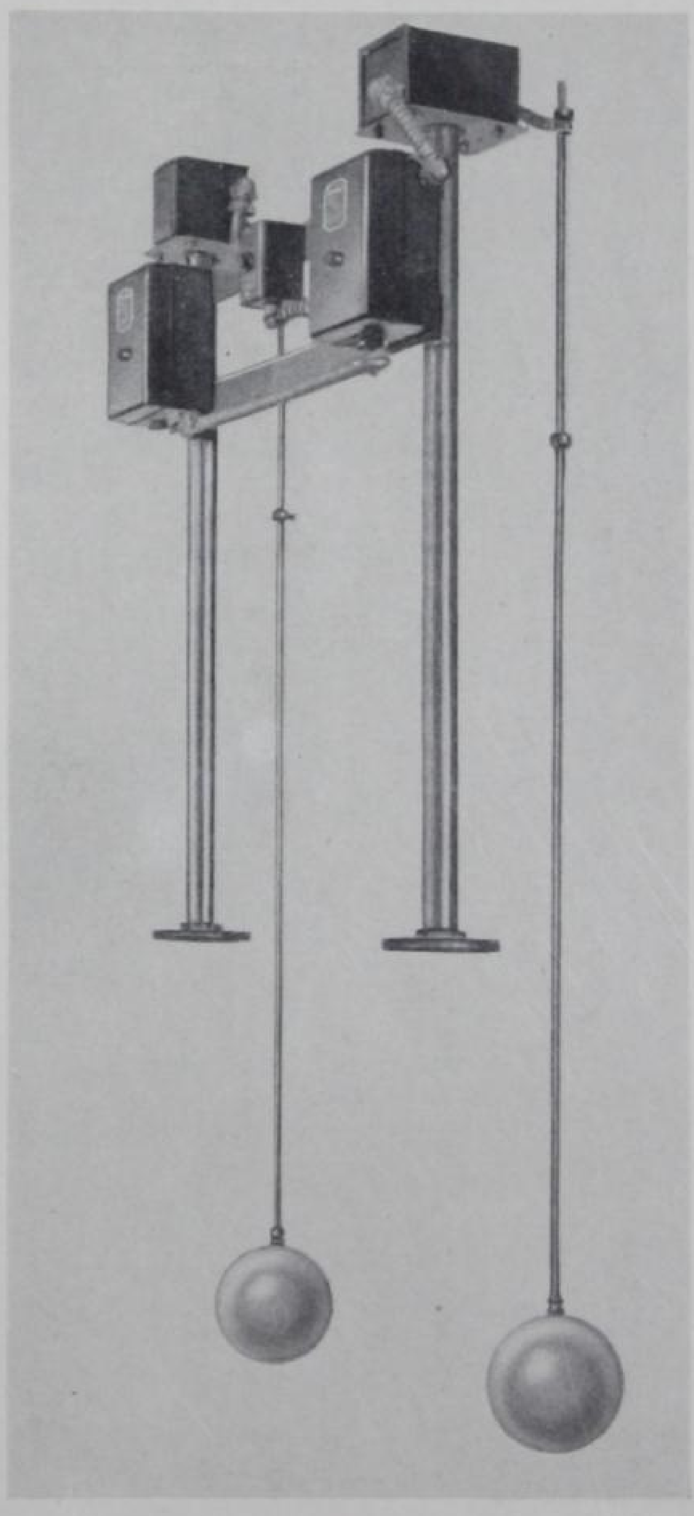


Fig. 6 — Central Duplex Control Panel.

A Guide to Determine the Proper Size

Selecting Size of Pump

While many charts and guides have been devised to aid in the selection of sewage and bilge pumps, service conditions alone determine the exact pump for a given duty. Factors influencing the decision are:

1. Nature of area to be drained,
2. Type of suspended matter in the liquid to be pumped,
3. Distance below sewer level,
4. Extent of waterproofing in basement.

A large safety factor to offset the unexpected should also be included, since the safety of property and equipment may depend upon the ability of pumps to dispose of the drainage. Unusual flood conditions can tax a pump beyond its ability to deliver.

First and absolutely necessary determinates are:

- The amount of drainage to be pumped in gallons per minute.
- The discharge head (height to which the drainage must be pumped), together with length of pipe and number of fittings from discharge of pump to drain.

How to Determine Capacity

To determine the gallonage to be pumped, consult the following table, which details the approximate flow in gallons per minute from various plumbing fixtures which contribute largely to ordinary drainage pumping.

Lavatory—two 3/8-inch connections	5 gpm
Bath tub—two 1/2-inch connections	8 gpm
Kitchen or pantry sink—two 1/2-inch connections	5 gpm
Shower, overhead spray only—two 1/2-inch connections	10 gpm
Shower, with side spray in addition to overhead spray	20 gpm
Slop sink—two 1/2-inch connections	6 gpm
Slop sink—two 3/4-inch connections	10 gpm
Laundry tray—two 1/2-inch connections	10 gpm
Water closet, tank type—one 3/8-inch connection	5 gpm
Water closet, flush valve — one 1-inch or one 1 1/4-inch connection	5 gpm
Urinal stall—one 3/8-inch connection	1/2 gpm
Drinking fountain—one 3/8-inch connection	1 gpm
Floor, drain, each	1 gpm
Drain tile — In clay or slow-seeping ground, per 100 sq. ft.	1 gpm
In sand and new made ground per 100 sq. ft.	5 gpm

Final calculations will depend on nature of soil and other varying conditions.

Typical Basement Diagram with Drainage and Sewage Connections

Fig. 7—Typical installation in basement where fixtures are below level of sewer. A screenless sewage pump is used to handle waste from lavatories, furnace pits, kitchens and other drainage containing foreign matter.

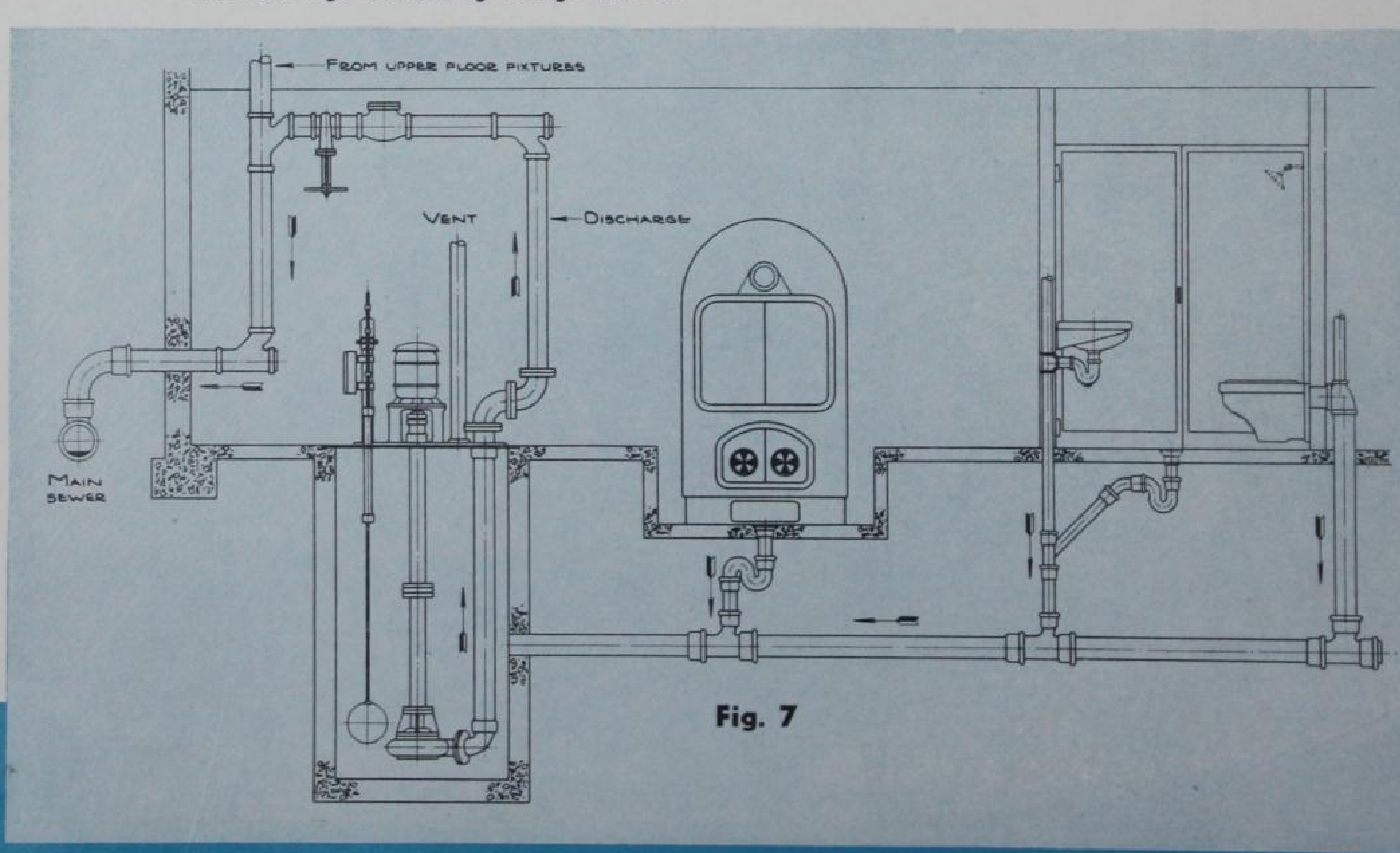


Fig. 7

Selection Guide

Use Factor for Various Building Types

Because types of buildings vary in the use made of plumbing fixtures, the totals found by means of the previous table should be multiplied by the following percentages, as illustrated in the typical example below.

Schools	65%	Office Buildings	35%
Mercantile Bldgs.	40%	Private Residences	20%
Hospitals	65%	Hotels and Clubs	40%
Apartment Bldgs. and Apartment Hotels			40%

Determining Depth of Basin

To allow ample storage of drainage, etc., provide at least 3 feet of depth below lowest inlet to the catch basin or sump. This will allow reasonably long cycles of pump operation and idleness. It will eliminate too-frequent starting and stopping of apparatus, which causes unnecessary wear and reduces the life of the equipment.

A Typical Example

A Hospital requires a sewage pump to handle the following fixtures located below sewer level:

10 Lavatories	@ 5 GPM —	50 GPM
5 Water Closets	@ 5 GPM —	25 GPM
3 Kitchen Sinks	@ 5 GPM —	15 GPM
2 Pantry Sinks	@ 5 GPM —	10 GPM
		100 GPM

Using a factor from the above table of 65% for this type of Building shows a net capacity of 65 GPM; to this we must add 50% as a margin of safety and arrive at a pump capacity of 97.5 GPM or approx. 100 GPM.

Assuming that the catch basin inlet enters at 2 feet below the floor and that the bottom of the basin is 3 feet below the inlet, a basin depth of 5 feet is required. If the sewer is 8 feet above the floor and friction amounts to 2 additional feet, a total head of 15 feet must be met. The selection tables on pages 16 and 17 show three pumps available for this duty, the exact pump depending on the motor speed desired.

About Discharge Pipe Sizes

As the dimension tables indicate, discharge pipes at the pump casing in Yeomans Darling Pumps are figured generously to reduce excess current requirement. The latter condition occurs when there is excessive pipe friction. On short discharge pipe runs, the same size pipe as listed in table on Page 18 may be used. In long runs it is far more economical to use larger pipe beyond the gate and check valves than to use smaller pipe and be obliged to operate the pump with greater input of electric power.

Basin Diameters and Adequate storage

Depending on local requirements and ordinances, basins of concrete, steel or cast iron may be used with these pumps. Basin diameters recommended in this bulletin are calculated on the basis of:

1. Ample usable storage capacity.
2. Minimum periodicity of pump operation.

Where quicksand, water-bearing strata and other underground difficulty occurs and the construction of a suitable basin is costly, proper storage capacity can, of course, be secured in a basin of larger diameter. In most instances, however, the recommended diameters will secure the best operating results. As a guide we suggest that the basin have a storage capacity between inlet level and one foot above bottom of sump, equal to the amount of water pump will handle in one minute.

How to Handle Back Pressure from Street

Fig. 8—In certain cases, it is necessary to pump sewage into street drains during times when they are overloaded causing a back pressure on the building drainage system. The method of installing a sewage pump for these conditions is shown in Fig. 8.

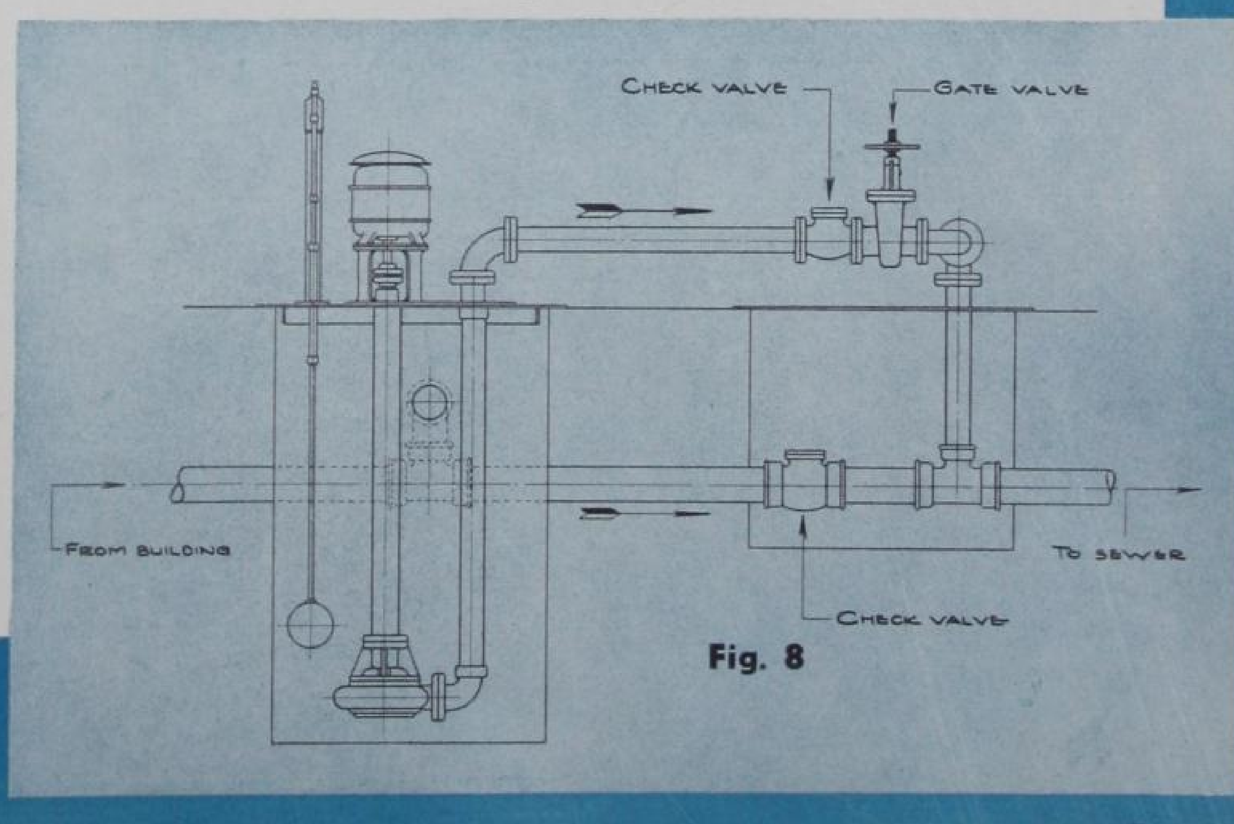
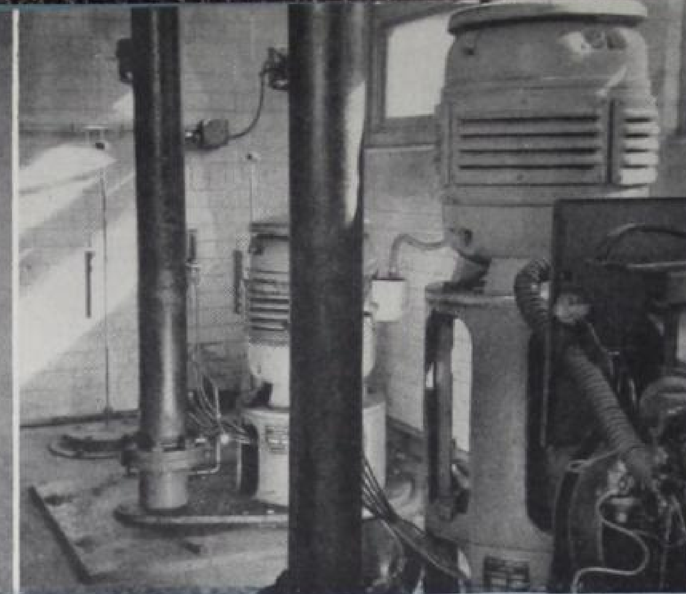
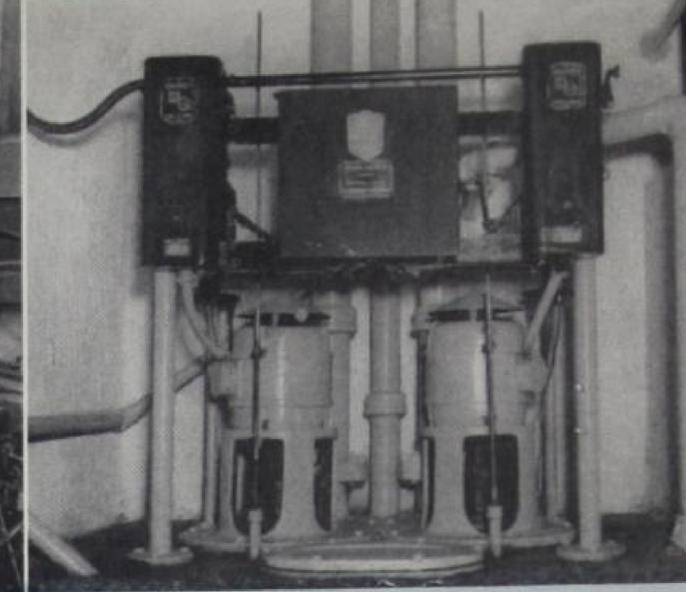


Fig. 8

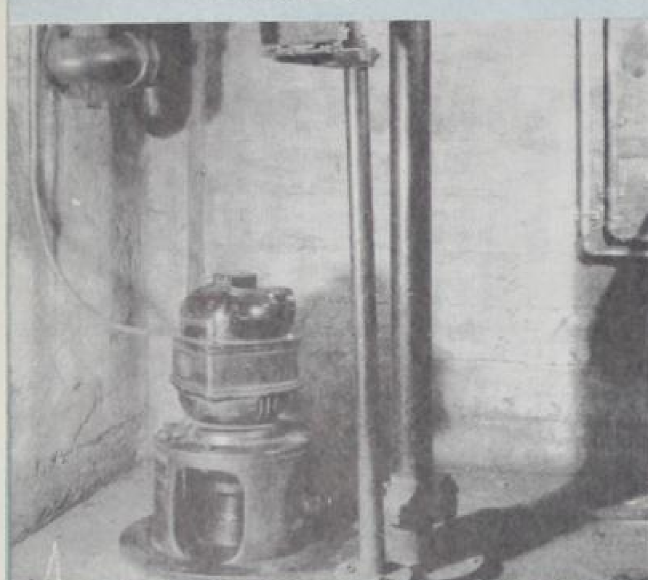
Trans-Canada Air Lines,
Malton, Ont.



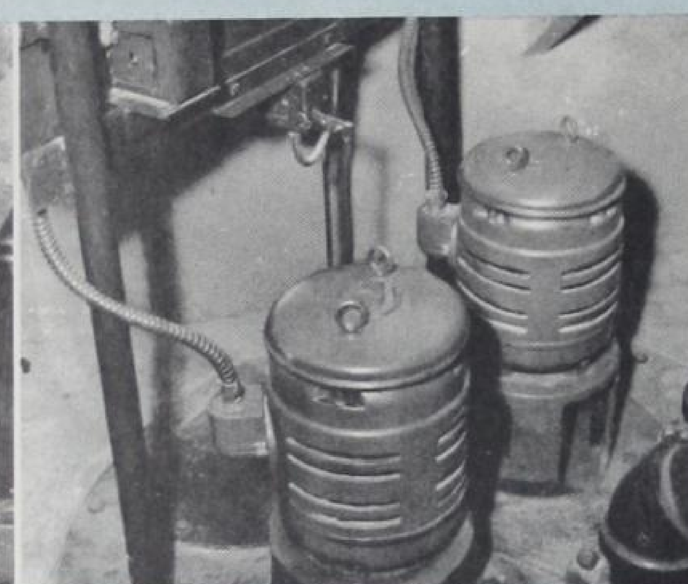
Canadair Ltd., Montreal, P.Q.
(Combination Drive)



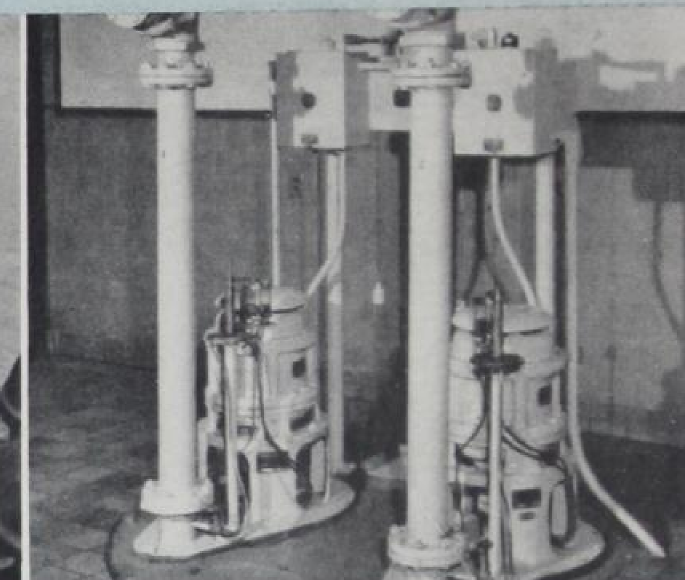
Bank of Nova Scotia,
Saint John, N.B.



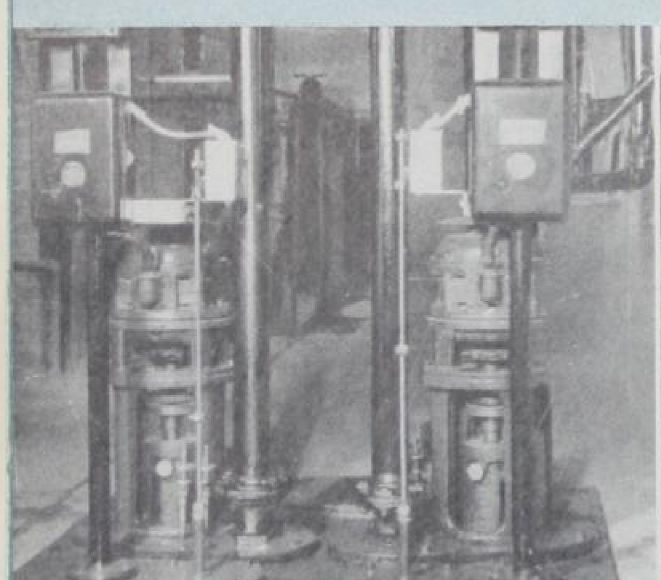
Civic Workshops,
Ottawa, Ont.



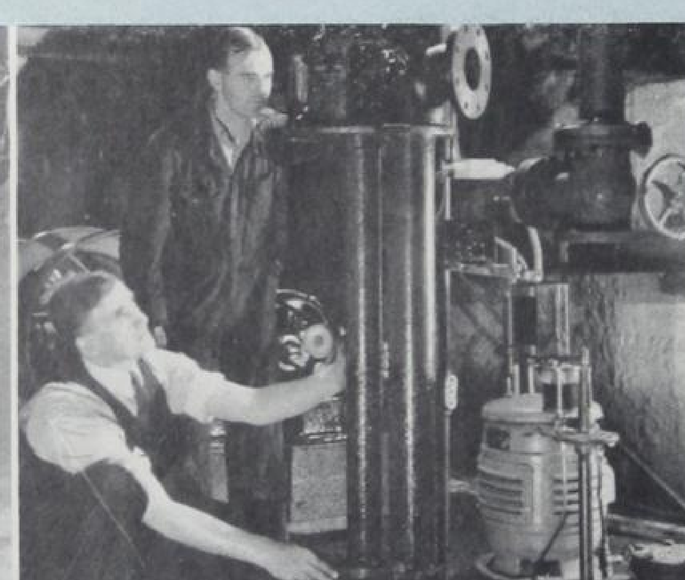
T. Eaton Co., Limited,
Edmonton, Alta.



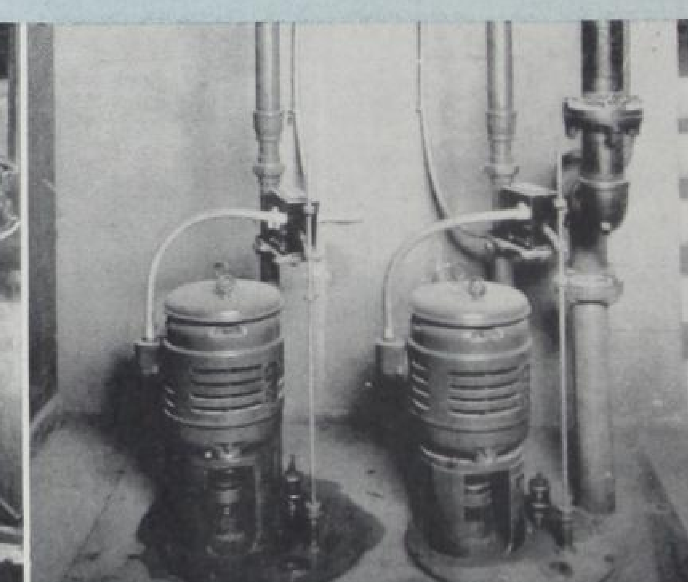
Canadian Bank of Commerce Bldg.
Toronto, Ont.



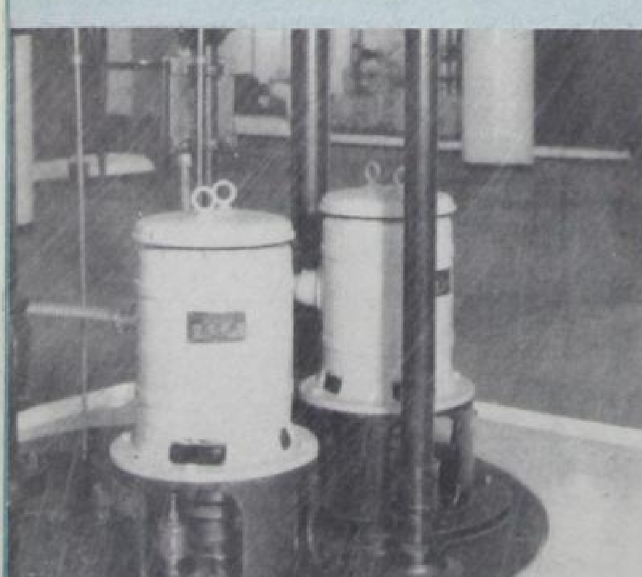
Montreal General Hospital,
Montreal, P.Q.



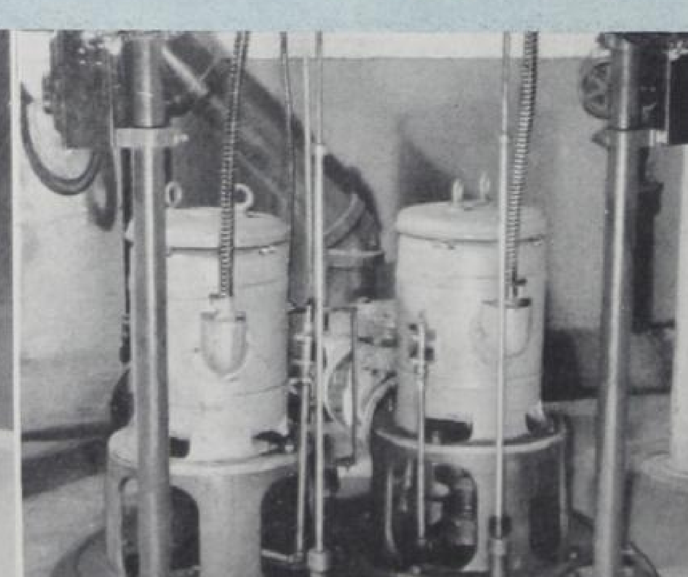
Transportation Building,
Montreal, P.Q.



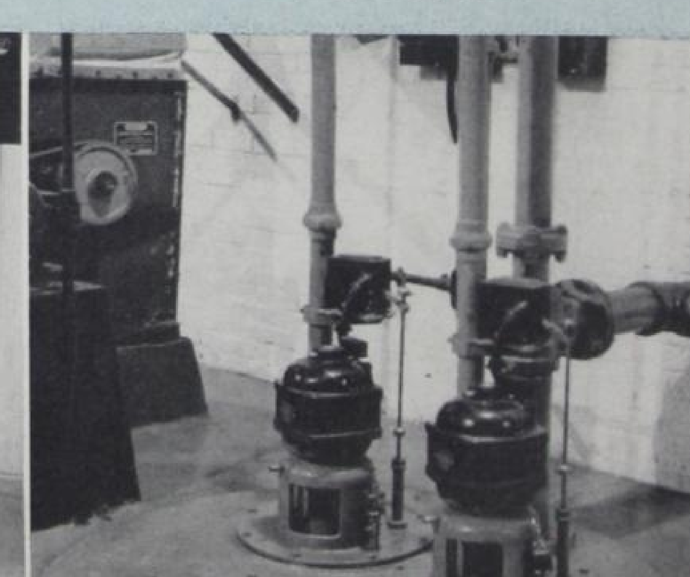
General Post Office,
Vancouver, B.C.



Winnipeg Free Press,
Winnipeg, Man.



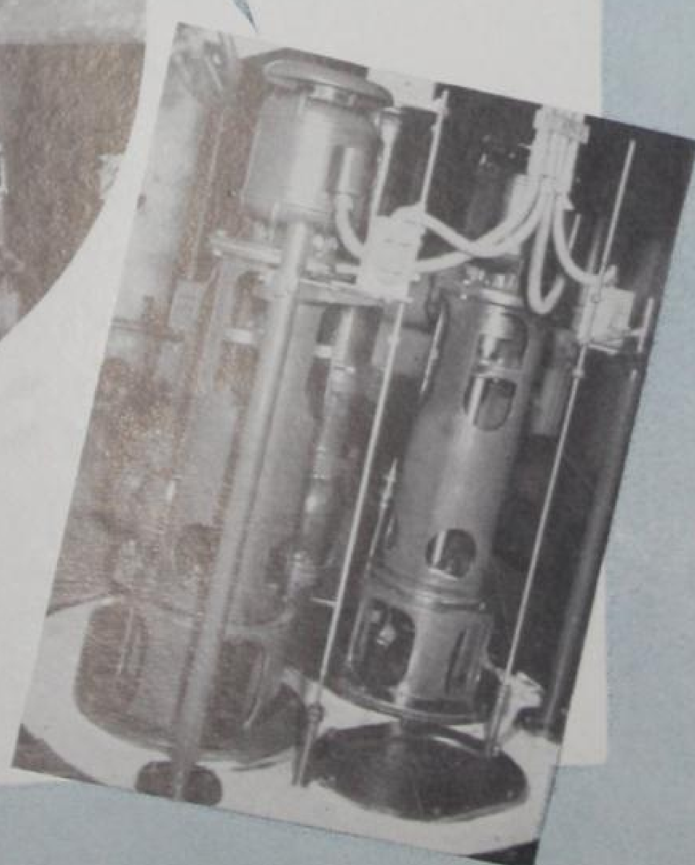
Young Men's Hebrew Association,
Montreal, P.Q.



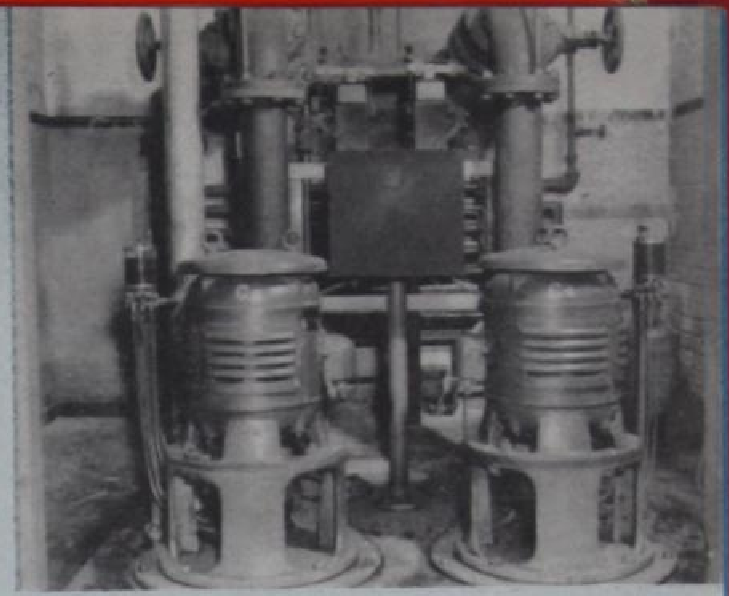
Post Office Building,
Halifax, N.S.

YEOMANS DARLING
Bilge and Sewage
PUMPS
IN SERVICE...
from COAST TO COAST

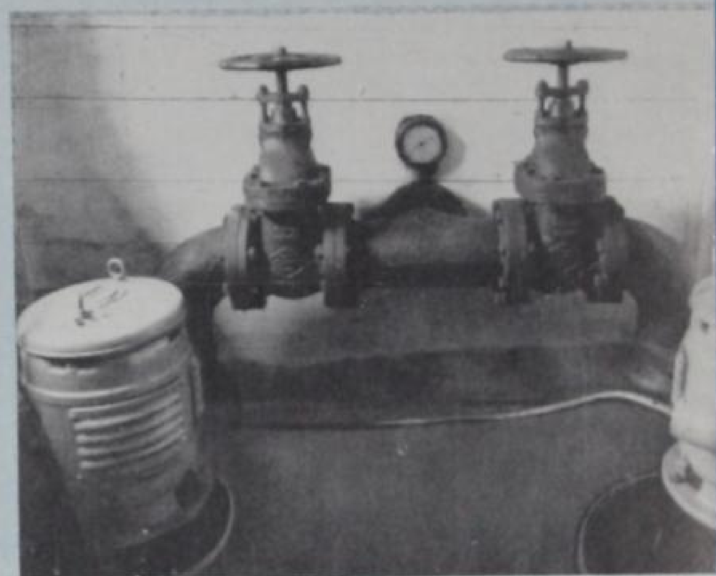
Henry Morgan & Co., Store, Montreal



Alberta Nitrogen Co., Ltd., Calgary, Alta. (Raised Motor)

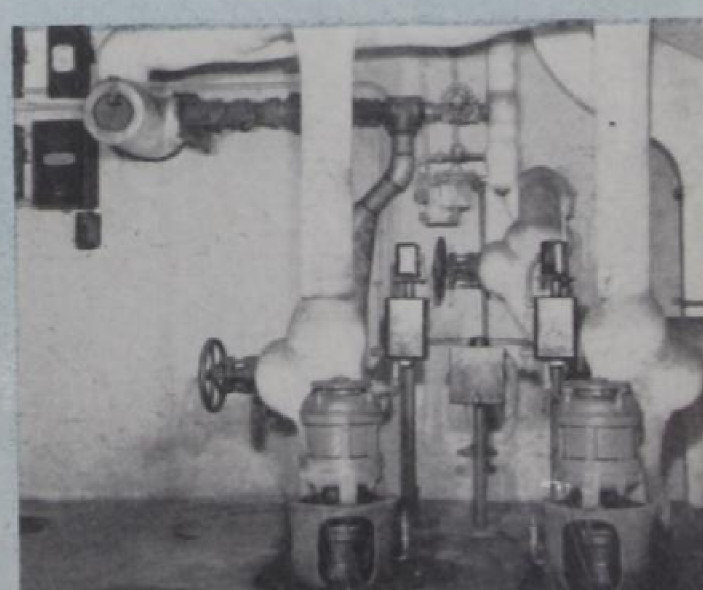


Dominion Arsenal St. Malo, P.Q.,



Town of Lloydminster, Saskatchewan

Provincial Government Building, Quebec, P.Q.



Ayerst, McKenna & Harrison Ltd. St. Laurent, P.Q.

Yeomans Darling Pumps for

Municipal Service
Grade Separation
Tunnel Drainage

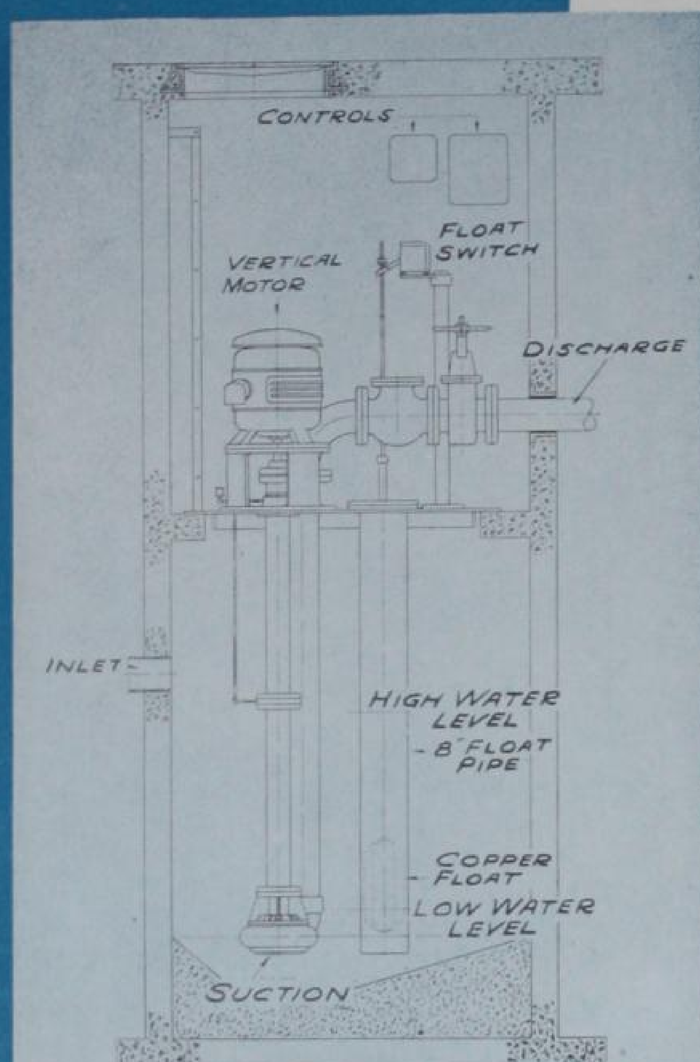


Fig. 9

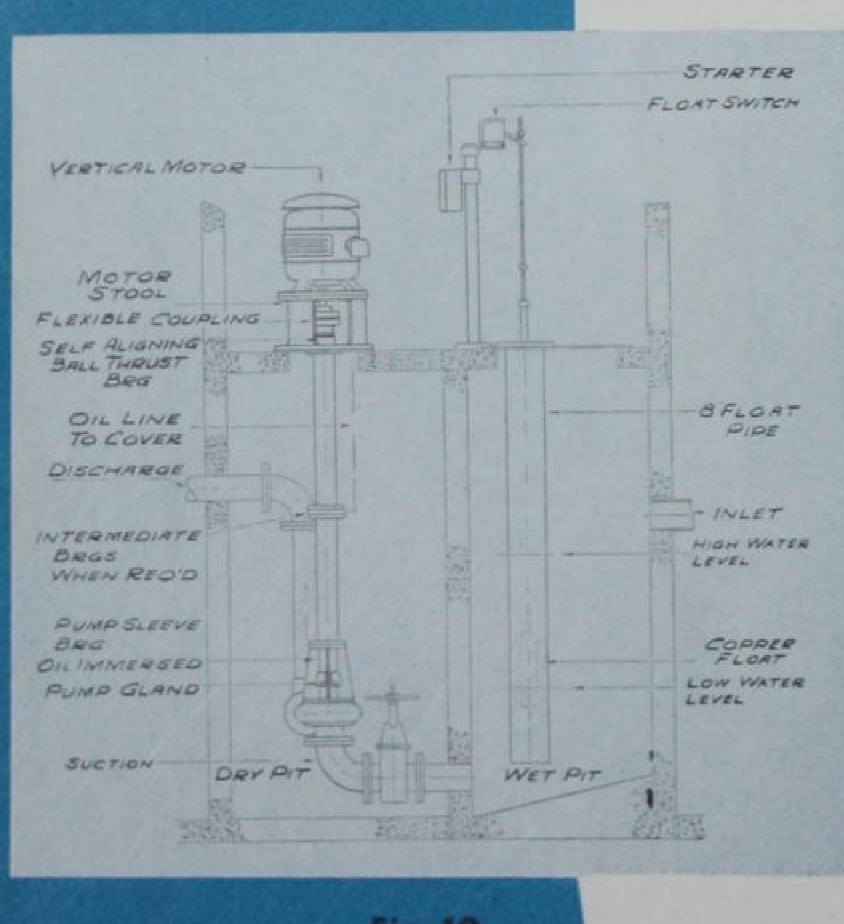


Fig. 10

Fig. 9 — Shows a Yeomans Darling Pump as usually installed to raise the sewage in a city sewer system so it will flow off by gravity. Concrete wet wells are used in place of cast iron basins to provide more storage capacity for flood periods and to lessen the frequency of pump operations.

Fig. 10 — Illustrates another type, the "dry pit" booster station. Here the pump is removed from the wet well and placed in a separate pit; the sewage is piped to the pump suction. This construction allows ready inspection of the pump and makes it easier to seal the wet well against the escape of gas and odors. The extra concrete work makes this a little more costly than the sumerged type installation.

For pumping drainage at grade seperations and tunnels a sewage pump is recommended to handle matter usually found in this type of drainage. Various types of pumps are manufactured by Yeomans Darling to provide safe and dependable pumping for this service. We have had long and extensive experience in the manufacture of sewage and bilge pumps for municipal service — requests for information will be promptly handled by our Branch or Representative in your territory listed on page 23.

Friction of Water in Pipes

Loss of Head in Feet due to Friction per 100 Feet of 15-Year-Old Ordinary Iron Pipe

U.S. Gallons per Minute	1½″ Pipe		2″ Pipe		2½″ Pipe		3″ Pipe		4″ Pipe		5″ Pipe		6″ Pipe		8″ Pipe		10″ Pipe		12″ Pipe	
	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Vel.	Fric.	Fric.	Vel.	Fric.
10	1.57	1.43	1.02	0.50	0.65	0.17	0.45	0.07	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15	2.36	3.0	1.53	1.08	0.98	0.36	0.68	0.15	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
20	3.15	5.2	2.04	1.82	1.31	0.61	0.91	0.25												
25	3.94	7.8	2.55	2.73	1.63	0.92	1.13	0.38												
30	4.72	11.0	3.06	3.84	1.96	1.29	1.36	0.54												
35	5.51	14.7	3.57	5.1	2.29	1.72	1.59	0.71	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
40	6.3	18.8	4.08	6.6	2.61	2.20	1.82	0.91	1.02	0.22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
45	7.08	23.2	4.60	8.2	2.94	2.80	2.05	1.15	1.17	0.28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
50	7.87	28.4	5.11	9.9	3.27	3.32	2.27	1.38	1.28	0.34	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
75	11.80	60.0	7.66	20.9	5.01	7.1	3.4	3.05	1.92	0.73	1.22	0.24	.....	.....	.....	.....	.....	.....	.....	.....
100	15.74	102.0	10.21	35.8	6.54	12.0	4.54	4.96	2.55	1.22	1.63	0.41	1.14	0.14	.....	.....	.....	.....	.....	.....
120	18.89	143.0	12.25	50.0	7.84	16.8	5.45	7.0	3.06	1.71	1.96	0.58	1.42	0.25	.....	.....	.....	.....	.....	.....
140	22.04	190.0	14.30	67.0	9.15	22.3	6.35	9.2	3.57	2.28	2.29	0.76	1.58	0.31	.....	.....	.....	.....	.....	.....
160	.....	.....	16.34	86.0	10.46	29.0	7.26	11.8	4.08	2.91	2.61	0.98	1.80	0.41	.....	.....	.....	.....	.....	.....
180	.....	.....	18.38	107.0	11.76	35.7	8.17	14.8	4.60	3.61	2.94	1.22	2.04	0.50	.....	.....	.....	.....	.....	.....
200	.....	.....	20.42	129.0	13.07	43.1	9.08	17.8	5.11	4.40	3.27	1.48	2.28	0.62	.....	.....	.....	.....	.....	.....
225	.....	.....	.....	.....	14.71	54.3	10.2	22.3	5.77	5.45	3.67	1.86	2.57	0.74	.....	.....	.....	.....	.....	.....
250	.....	.....	.....	.....	16.3	66.0	11.32	27.2	6.40	6.72	4.08	2.24	2.80	0.92	1.60	0.22	.....	.....	.....	.....
275	.....	.....	.....	.....	.....	.....	12.50	32.5	7.03	7.99	4.50	2.72	3.06	1.15	1.73	0.27	.....	.....	.....	.....
300	.....	.....	.....	.....	.....	.....	13.62	38.0	7.66	9.30	4.90	3.14	3.40	1.29	1.90	0.32	.....	.....	.....	.....
350	.....	.....	.....	.....	.....	.....	.....	.....	8.90	12.32	5.72	4.19	3.98	1.75	2.20	0.42	.....	.....	.....	.....
400	.....	.....	.....	.....	.....	.....	.....	.....	10.21	16.00	6.54	5.40	4.54	2.21	2.60	0.54	.....	.....	.....	.....
450	.....	.....	.....	.....	.....	.....	.....	.....	11.50	19.80	7.35	6.70	5.12	2.65	2.92	0.68	1.80	0.21	.....	.....
475	.....	.....	.....	.....	.....	.....	.....	.....	12.20	22.96	7.76	7.42	5.55	2.95	3.10	0.76	1.94	0.25	.....	.....
500	.....	.....	.....	.....	.....	.....	.....	.....	12.77	24.00	8.17	8.12	5.60	3.30	3.20	0.82	2.04	0.28	1.42	0.11
550	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8.99	9.60	6.16	3.93	3.52	0.97	2.25	0.33	1.57	0.14
600	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9.80	11.30	6.72	4.70	3.84	1.14	2.46	0.39	1.71	0.15
650	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10.62	13.20	7.28	5.40	4.16	1.34	2.66	0.46	1.85	0.19
700	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11.44	15.10	7.84	6.20	4.46	1.54	2.86	0.52	2.00	0.22
800	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9.08	8.00	5.12	1.97	3.28	0.67	2.27	0.27
900	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10.30	10.11	5.75	2.46	3.68	0.83	2.56	0.34
1000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11.32	12.04	6.40	3.02	4.08	1.01	2.84	0.41
1100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12.50	14.31	7.03	3.51	4.50	1.20	3.13	0.49
1200	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13.52	16.69	7.67	4.15	4.91	1.46	3.41	0.57
1500	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9.60	6.27	6.10	2.09	4.20	0.85
2000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12.70	10.71	8.10	3.65	5.60	1.43
2500	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10.10	5.33	7.00	2.28

Vel.—Velocity ft. per second. Fric.—Friction Head in Feet.

Friction of Water in 90° Elbows

Equivalent Number of Feet Straight Pipe

Size of Elbow, Inches....	1½	2	2½	3	4	5	6	8	10	12
Friction Equivalent Feet Straight Pipe........	8	8	11	15	16	18	18	24	30	40

Relative Quantities of Water

Delivered in 1 Minute, in 1 Hour and in 24 Hours

Gals. In 1 Min.	Gals. In 1 Hour	Gals. In 24 Hours	Gals. In 1 Min.	Gals. In 1 Hour	Gals. In 24 Hours	Gals. In 1 Min.	Gals. In 1 Hour	Gals. In 24 Hours
3.4	208	5,000	138.8	8,333	200,000	486.1	29,166	700,000
6.9	416	10,000	173.6	10,416	250,000	520.8	31,250	750,000
10.4	625	15,000	208.3	12,500	300,000	555.5	33,333	800,000
13.8	833	20,000	243.0	14,583	350,000	590.2	35,416	850,000
17.3	1,041	25,000	277.7	16,666	400,000	625.0	37,500	900,000
34.7	2,083	50,000	312.5	18,750	450,000	659.7	39,583	950,000
41.6	2,500	60,000	347.2	20,833	500,000	964.3	41,666	1,000,000
52.9	3,125	75,000	381.9	22,916	550,000	1,041.7	62,500	1,500,000
69.4	4,166	100,000	416.7	25,000	600,000	1,388.0	83,333	2,000,000
104.1	6,250	150,000	451.3	27,083	650,000	1,736.0	104.166	2,500,000

SELECTION CHART

Yeomans Darling Screenless Sewage Pumps

RPM	HEAD IN FEET	CODE MOTOR	CAPACITY U.S. GALLONS PER MINUTE										
			50	75	100	125	150	200	250	300	400	500	6[illegible]0
720	10	CODE MOTOR	5YS10A ½ HP	7YS10A ½ HP	10YS10A ½ HP	12YS10A ¾ HP	15YS10A ¾ HP	20YS10A 1 HP	25YS10A 1 HP	30YS10A 1½ HP	40YS10A 2 HP		
	15	CODE MOTOR	5YS15A ¾ HP	7YS15A ¾ HP	10YS15A 1 HP	12YS15A 1 HP	15YS15A 1 HP	20YS15A 1½ HP	25YS15A 1½ HP	30YS15A 2 HP	40YS15A 3 HP		
	20	CODE MOTOR	5YS20A 1 HP	7YS20A 1 HP	10YS20A 1 HP	12YS20A 1½ HP	15YS20A 1½ HP	20YS20A 1½ HP	25YS20A 2 HP	30YS20A 3 HP	40YS20A 3 HP		
850	10	CODE MOTOR	5YS10B ½ HP	7YS10B ½ HP	10YS10B ¾ HP	12YS10B ¾ HP	15YS10B ¾ HP	20YS10B 1 HP	25YS10B 1½ HP	30YS10B 1½ HP	40YS10B 2 HP		
	15	CODE MOTOR	5YS15B ¾ HP	7YS15B ¾ HP	10YS15B 1 HP	12YS15B 1 HP	15YS15B 1 HP	20YS15B 1½ HP	25YS15B 1½ HP	30YS15B 2 HP	40YS15B 3 HP		
	20	CODE MOTOR	5YS20B 1 HP	7YS20B 1 HP	10YS20B 1 HP	12YS20B 1½ HP	15YS20B 1½ HP	20YS20B 2 HP	25YS20B 2 HP	30YS20B 3 HP	40YS20B 3 HP		
	25	CODE MOTOR	5YS25B 1½ HP	7YS25B 1½ HP	10YS25B 1½ HP	12YS25B 2 HP	15YS25B 2 HP	20YS25B 3 HP	25YS25B 3 HP	30YS25B 3 HP	40YS25B 5 HP		
1150	10	CODE MOTOR	5YS10C ½ HP	7YS10C ¾ HP	10YS10C ¾ HP	12YS10C ¾ HP	15YS10C 1 HP	20YS10C 1 HP	25YS10C 1½ HP	30YS10C 1½ HP	40YS10C 2 HP.		
	15	CODE MOTOR	5YS15C ¾ HP	7YS15C ¾ HP	10YS15C 1 HP	12YS15C 1 HP	15YS15C 1½ HP	20YS15C 1½ HP	25YS15C 2 HP	30YS15C 2 HP	40YS15C 3 HP		
	20	CODE MOTOR	5YS20C 1 HP	7YS20C 1 HP	10YS20C 1½ HP	12YS20C 1½ HP	15YS20C 1½ HP	20YS20C 2 HP	25YS20C 3 HP	30YS20C 3 HP	40YS20C 5 HP		
	25	CODE MOTOR	5YS25C 1½ HP	7YS25C 1½ HP	10YS25C 1½ HP	12YS25C 2 HP	15YS25C 2 HP	20YS25C 3 HP	25YS25C 3 HP	30YS25C 3 HP	40YS25C 5 HP		
	30	CODE MOTOR	5YS30C 2 HP	7YS30C 2 HP	10YS30C 3 HP	12YS30C 3 HP	15YS30C 3 HP	20YS30C 3 HP	25YS30C 5 HP	30YS30C 5 HP	40YS30C 5 HP		
	40	CODE MOTOR	5YS40C 3 HP	7YS40C 3 HP	10YS40C 5 HP	12YS40C 5 HP	15YS40C 5 HP	20YS40C 5 HP	25YS40C 5 HP	30YS40C 7½ HP	40YS40C 7½ HP		
1450	10	CODE MOTOR		7YS10D ¾ HP	10YS10D ¾ HP	12YS10D ¾ HP	15YS10D 1 HP	20YS10D 1½ HP	25YS10D 1½ HP	30YS10D 2 HP	40YS10D 3 HP		
	15	CODE MOTOR		7YS15D 1 HP	10YS15D 1 HP	12YS15D 1½ HP	15YS15D 1½ HP	20YS15D 1½ HP	25YS15D 2 HP	30YS15D 3 HP	40YS15D 3 HP		
	20	CODE MOTOR		7YS20D 1½ HP	10YS20D 1½ HP	12YS20D 1½ HP	15YS20D 1½ HP	20YS20D 2 HP	25YS20D 3 HP	30YS20D 3 HP	40YS20D 5 HP		
	25	CODE MOTOR		7YS25D 1½ HP	10YS25D 1½ HP	12YS25D 2 HP	15YS25D 2 HP	20YS25D 3 HP	25YS25D 3 HP	30YS25D 5 HP	40YS25D 5 HP		
	30	CODE MOTOR		7YS30D 2 HP	10YS30D 3 HP	12YS30D 3 HP	15YS30D 3 HP	20YS30D 3 HP	25YS30D 5 HP	30YS30D 5 HP	40YS30D 5 HP		
	40	CODE MOTOR		7YS40D 3 HP	10YS40D 3 HP	12YS40D 3 HP	15YS40D 5 HP	20YS40D 5 HP	25YS40D 5 HP	30YS40D 7½ HP	40YS40D 7½ HP		
1750	10	CODE MOTOR											
	15	CODE MOTOR		7YS15E 1 HP	10YS15E 1 HP	12YS15E 1½ HP	15YS15E 1½ HP	20YS15E 2 HP	25YS15E 2 HP	30YS15E 3 HP	40YS15E 5 HP		
	20	CODE MOTOR		7YS20E 1½ HP	10YS20E 1½ HP	12YS20E 1½ HP	15YS20E 2 HP	20YS20E 2 HP	25YS20E 3 HP	30YS20E 5 HP	40YS20E 5 HP		
	25	CODE MOTOR		7YS25E 1½ HP	10YS25E 1½ HP	12YS25E 2 HP	15YS25E 3 HP	20YS25E 3 HP	25YS25E 3 HP	30YS25E 5 HP	40YS25E 5 HP		
	30	CODE MOTOR			10YS30E 2 HP	12YS30E 3 HP	15YS30E 3 HP	20YS30E 3 HP	25YS30E 5 HP	30YS30E 5 HP	40YS30E 5 HP		
	40	CODE MOTOR			10YS40E 3 HP	12YS40E 3 HP	15YS40E 5 HP	20YS40E 5 HP	25YS40E 5 HP	30YS40E 7½ HP	40YS40E 7½ HP		

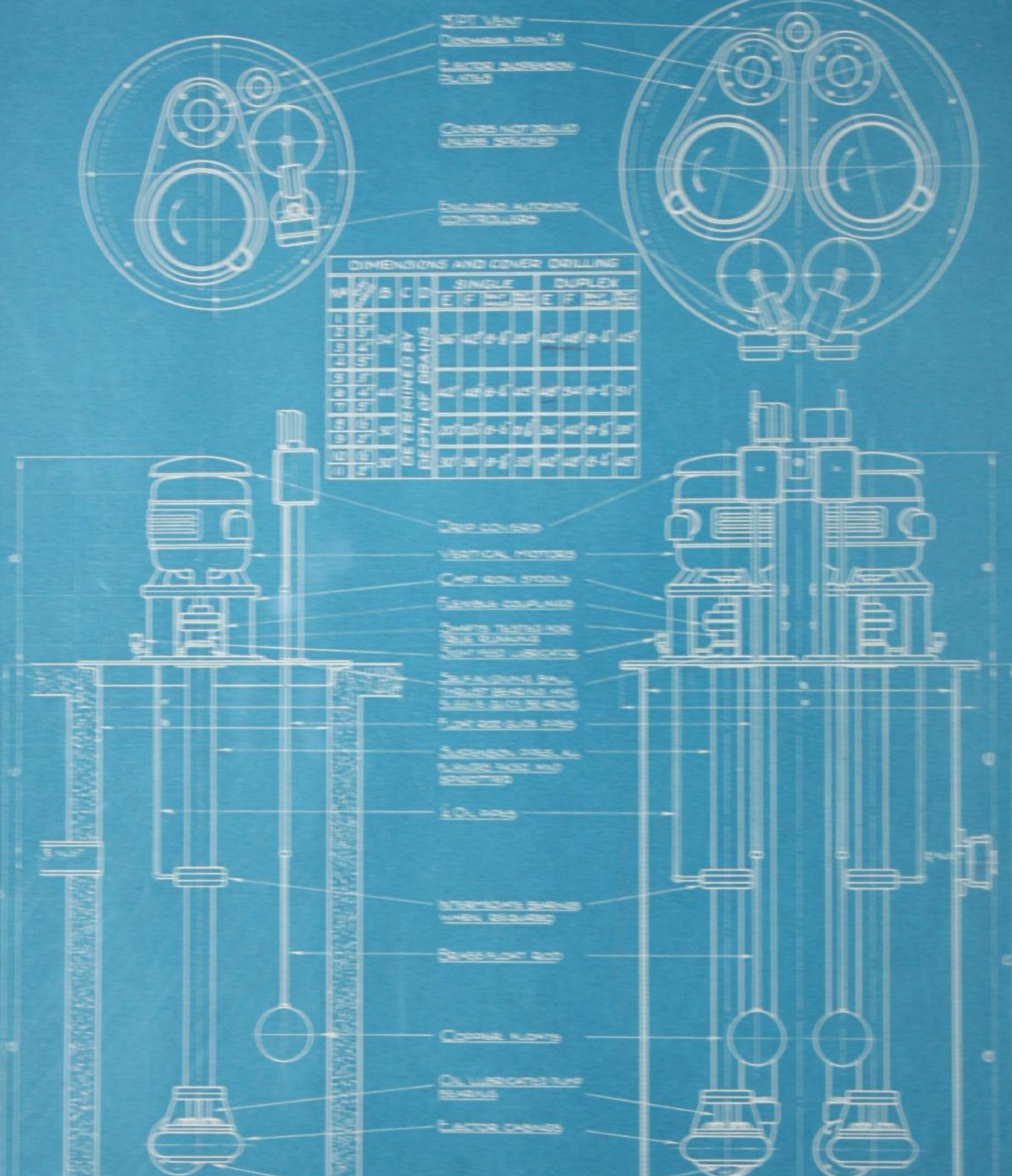
LARGER SIZE PUMPS MANUFACTURED
PRICES ON REQUEST

SELECTION CHART

Yeomans Darling Bilge Pumps

RPM	HEAD IN FEET	CODE / MOTOR	15	25	35	50	75	100	125	150	200	250	300	400
			CAPACITY U.S. GALLONS PER MINUTE											
1150	10	CODE MOTOR	1YB10C ⅓ HP	2YB10C ⅓ HP	3YB10C ⅓ HP	5YB10C ½ HP	7YB10C ½ HP	10YB10C ¾ HP	12YB10C ¾ HP	15YB10C 1 HP	20YB10C 1 HP	25YB10C 1½ HP	30YB10C 1½ HP	40YB10C 2 HP
1150	15	CODE MOTOR	1YB15C ⅓ HP	2YB15C ⅓ HP	3YB15C ½ HP	5YB15C ½ HP	7YB15C ¾ HP	10YB15C 1 HP	12YB15C 1 HP	15YB15C 1 HP	20YB15C 1½ HP	25YB15C 2 HP	30YB15C 2 HP	40YB15C 3 HP
1150	20	CODE MOTOR	1YB20C ⅓ HP	2YB20C ½ HP	3YB20C ½ HP	5YB20C ½ HP	7YB20C ¾ HP	10YB20C 1 HP	12YB20C 1½ HP	15YB20C 1½ HP	20YB20C 2 HP	25YB20C 2 HP	30YB20C 3 HP	40YB20C 3 HP
1150	25	CODE MOTOR	1YB25C ½ HP	2YB25C ½ HP	3YB25C ½ HP	5YB25C ¾ HP	7YB25C 1 HP	10YB25C 1½ HP	12YB25C 1½ HP	15YB25C 1½ HP	20YB25C 2 HP	25YB25C 2 HP	30YB25C 3 HP	40YB25C 5 HP
1150	30	CODE MOTOR	1YB30C ½ HP	2YB30C ½ HP	3YB30C ¾ HP	5YB30C 1 HP	7YB30C 1 HP	10YB30C 1½ HP	12YB30C 2 HP	15YB30C 2 HP	20YB30C 3 HP	25YB30C 3 HP	30YB30C 5 HP	40YB30C 5 HP
1150	40	CODE MOTOR	1YB40C ¾ HP	2YB40C 1 HP	3YB40C 1 HP	5YB40C 1½ HP	7YB40C 2 HP	10YB40C 2 HP	12YB40C 3 HP	15YB40C 3 HP	20YB40C 5 HP	25YB40C 5 HP	30YB40C 5 HP	40YB40C 7½ HP
1150	50	CODE MOTOR	1YB50C 1 HP	2YB50C 1½ HP	3YB50C 1½ HP	5YB50C 1½ HP	7YB50C 2 HP	10YB50C 3 HP	12YB50C 3 HP	15YB50C 5 HP	20YB50C 5 HP	25YB50C 5 HP	30YB50C 7½ HP	40YB50C 7½ HP
1150	60	CODE MOTOR	1YB60C 1½ HP	2YB60C 1½ HP	3YB60C 2 HP	5YB60C 2 HP	7YB60C 3 HP	10YB60C 3 HP	12YB60C 5 HP	15YB60C 5 HP	20YB60C 5 HP	25YB60C 7½ HP	30YB60C 7½ HP	40YB60C 10 HP
1450	10	CODE MOTOR	1YB10D ⅓ HP	2YB10D ⅓ HP	3YB10D ⅓ HP	5YB10D ½ HP	7YB10D ½ HP	10YB10D ¾ HP	12YB10D 1 HP	15YB10D 1 HP	20YB10D 1 HP	25YB10D 1½ HP	30YB10D 2 HP	40YB10D 3 HP
1450	15	CODE MOTOR	1YB15D ⅓ HP	2YB15D ⅓ HP	3YB15D ½ HP	5YB15D ½ HP	7YB15D ¾ HP	10YB15D ¾ HP	12YB15D 1 HP	15YB15D 1½ HP	20YB15D 1½ HP	25YB15D 2 HP	30YB15D 2 HP	40YB15D 3 HP
1450	20	CODE MOTOR	1YB20D ⅓ HP	2YB20D ½ HP	3YB20D ½ HP	5YB20D ½ HP	7YB20D ¾ HP	10YB20D 1 HP	12YB20D 1½ HP	15YB20D 1½ HP	20YB20D 2 HP	25YB20D 2 HP	30YB20D 3 HP	40YB20D 3 HP
1450	25	CODE MOTOR	1YB25D ½ HP	2YB25D ½ HP	3YB25D ¾ HP	5YB25D ¾ HP	7YB25D 1 HP	10YB25D 1½ HP	12YB25D 1½ HP	15YB25D 2 HP	20YB25D 2 HP	25YB25D 3 HP	30YB25D 3 HP	40YB25D 5 HP
1450	30	CODE MOTOR	1YB30D ¾ HP	2YB30D ¾ HP	3YB30D ¾ HP	5YB30D 1 HP	7YB30D 1 HP	10YB30D 1½ HP	12YB30D 2 HP	15YB30D 2 HP	20YB30D 3 HP	25YB30D 3 HP	30YB30D 5 HP	40YB30D 5 HP
1450	40	CODE MOTOR	1YB40D ¾ HP	2YB40D 1 HP	3YB40D 1 HP	5YB40D 1 HP	7YB40D 1½ HP	10YB40D 2 HP	12YB40D 3 HP	15YB40D 3 HP	20YB40D 3 HP	25YB40D 5 HP	30YB40D 5 HP	40YB40D 7½ HP
1450	50	CODE MOTOR	1YB50D 1 HP	2YB50D 1 HP	3YB50D 1½ HP	5YB50D 1½ HP	7YB50D 2 HP	10YB50D 3 HP	12YB50D 3 HP	15YB50D 5 HP	20YB50D 5 HP	25YB50D 5 HP	30YB50D 7½ HP	40YB50D 7½ HP
1450	60	CODE MOTOR	1YB60D 1½ HP	2YB60D 1½ HP	3YB60D 2 HP	5YB60D 2 HP	7YB60D 3 HP	10YB60D 3 HP	12YB60D 5 HP	15YB60D 5 HP	20YB60D 5 HP	25YB60D 7½ HP	30YB60D 7½ HP	40YB60D 10 HP
1750	10	CODE MOTOR	1YB10E ⅓ HP	2YB10E ⅓ HP	3YB10E ⅓ HP	5YB10E ½ HP	7YB10E ½ HP	10YB10E ¾ HP						
1750	15	CODE MOTOR	1YB15E ⅓ HP	2YB15E ⅓ HP	3YB15E ½ HP	5YB15E ½ HP	7YB15E ¾ HP	10YB15E ¾ HP	12YB15E 1 HP	15YB15E 1½ HP	20YB15E 2 HP	25YB15E 2 HP	30YB15E 2 HP	
1750	20	CODE MOTOR	1YB20E ⅓ HP	2YB20E ½ HP	3YB20E ½ HP	5YB20E ¾ HP	7YB20E ¾ HP	10YB20E 1 HP	12YB20E 1½ HP	15YB20E 1½ HP	20YB20E 1½ HP	25YB20E 2 HP	30YB20E 3 HP	40YB20E 3 HP
1750	25	CODE MOTOR	1YB25E ½ HP	2YB25E ½ HP	3YB25E ¾ HP	5YB25E ¾ HP	7YB25E 1 HP	10YB25E 1½ HP	12 YB25E 1½ HP	15YB25E 2 HP	20YB25E 2 HP	25YB25E 3 HP	30YB25E 3 HP	40YB25E 5 HP
1750	30	CODE MOTOR	1YB30E ¾ HP	2YB30E ¾ HP	3YB30E ¾ HP	5YB30E 1 HP	7YB30E 1 HP	10YB30E 1½ HP	12YB30E 2 HP	15YB30E 2 HP	20YB30E 2 HP	25YB30E 3 HP	30YB30E 3 HP	40YB30E 5 HP
1750	40	CODE MOTOR	1YB40E 1 HP	2YB40E 1 HP	3YB40E 1 HP	5YB40E 1 HP	7YB40E 1½ HP	10YB40E 2 HP	12YB40E 2 HP	15YB40E 3 HP	20YB40E 3 HP	25YB40E 5 HP	30YB40E 5 HP	40YB40E 7½ HP
1750	50	CODE MOTOR	1YB50E 1 HP	2YB50E 1 HP	3YB50E 1½ HP	5YB50E 1½ HP	7YB50E 2 HP	10YB50E 3 HP	12YB50E 3 HP	15YB50E 3 HP	20YB50E 5 HP	25YB50E 5 HP	30YB50E 7½ HP	40YB50E 7½ HP
1750	60	CODE MOTOR	1YB60E 1½ HP	2YB60E 1½ HP	3YB60E 1½ HP	5YB60E 2 HP	7YB60E 2 HP	10YB60E 3 HP	12YB60E 3 HP	15YB60E 5 HP	20YB60E 5 HP	25YB60E 7½ HP	30YB60E 7½ HP	40YB60E 7½ HP

Recommended Dimensions and Details



Typical Specifications

SEWAGE PUMP:

Furnish and install where indicated on plans one Single/Duplex Yeomans Darling Type YS Heavy Duty Screenless Sewage Pump, having a capacity of..... U.S.G.P.M. against a total head of..... feet from all causes, in a sump...... feet in diameter by..... feet deep.

Pump shall be fitted with a special screenless nickle-iron casing and bronze enclosed impeller, both capable of handling solids 2½" minimum diameter. Impeller to be secured to tapered, keyed and threaded end of large ground steel shaft by means of bronze cap nut. Shaft and ball thrust bearing to be designed for axial adjustment to maintain clearances between impeller eye and casing.

Pump shall be suspended from base by a rigid suspension pipe, at the lower end of which is a sealed oil immersed sleeve bearing separated from casing. One intermediate oil lubricated guide bearing shall be furnished for each 6 feet of sump depth.

All parts of unit are to be positively located in position by machined spigots or shoulders in base, hanger pipe, casing, shaft and impeller, and to be fastened together by studs and nuts or through bolts. All keys to be fitted on top and sides without use of set screws.

MOTOR:

Motor shall be mounted on a spigotted stool, cast integrally with the base. Supply a continuous rated 40° C. rise..... H.P..... R.P.M. vertical NEMA frame motor with drip cover to drive pump through a pin and rubber buffer flexible coupling. Motor to operate on..... phase..... cycle..... volts electric current.

CONTROL:

Automatic control equipment shall consist of a heavy duty butt contact float actuated switch, controlling the pilot circuit of a magnetic contactor starter fitted with overload relays.

All the above mounted on a heavy steel stand bolted to the pit cover. Float and guide to be removable from pit without disturbing pump or sump cover.

COVER PLATE:

Sump cover plate shall be of steel, of a suitable diameter and thickness for a...... diam pit. Vent opening shall be provided.

EXTRA EQUIPMENT:

Float guide pipe, slower speed motors, curb rings, high water alarm, electronic control and oil economizer; special alloys and construction should be noted by Engineer in his specification. Automatic alternation of pump operation can be provided by the use of an alternator for Duplex Pump sets.

BILGE PUMP:

Furnish and install where indicated on plans one Single/Duplex Yeomans Darling Type YB Heavy Duty Bilge Pump, having a capacity of...... U.S.G.P.M. against a total head of...... feet from all causes, in a sump..... feet in diameter by..... feet deep.

Pump shall be fitted with nickle-iron volute casing and bronze enclosed impeller. Impeller to be secured to tapered, keyed and threaded end of large ground steel shaft by means of bronze cap nut and key.

Pump shall be suspended from base by a rigid suspension pipe, at the lower end of which is a sealed oil immersed sleeve bearing separated from casing. One intermediate oil lubricated guide bearing shall be furnished for each 6 feet of sump depth.

All parts of unit are to be positively located in position by machined spigots or shoulders in base, hanger pipe, casing, shaft and impeller, and to be fastened together by studs and nuts or through bolts. All keys to be fitted on top and sides without use of set screws.

MOTOR:

Motor shall be mounted on a spigotted stool, cast integrally with the base. Supply a continuous rated 40° C. rise..... H.P..... R.P.M. vertical NEMA frame motor with drip cover to drive pump through a pin and rubber buffer flexible coupling. Motor to operate on..... phase..... cycle..... volts electric current.

CONTROL:

Automatic control equipment shall consist of a heavy duty butt contact float actuated switch, controlling the pilot circuit of a magnetic contactor starter fitted wih overload relays.

All the above mounted on a heavy steel stand bolted to the pit cover. Float and guide to be removable from pit without disturbing pump or sump cover.

COVER PLATE:

Sump cover plate shall be of steel, of a suitable diameter and thickness for a..... diam. pit. Vent opening shall be provided.

EXTRA EQUIPMENT:

Float guide pipe, slower speed motors, curb rings, high water alarm, electronic control and automatic oil economizer; special alloys and construction should be noted by Engineer in his specification. Automatic alternation of pump operation can be provided by the use of an alternator for Duplex Pump sets.

Yeomans Darling Pumps for
SPECIAL APPLICATIONS

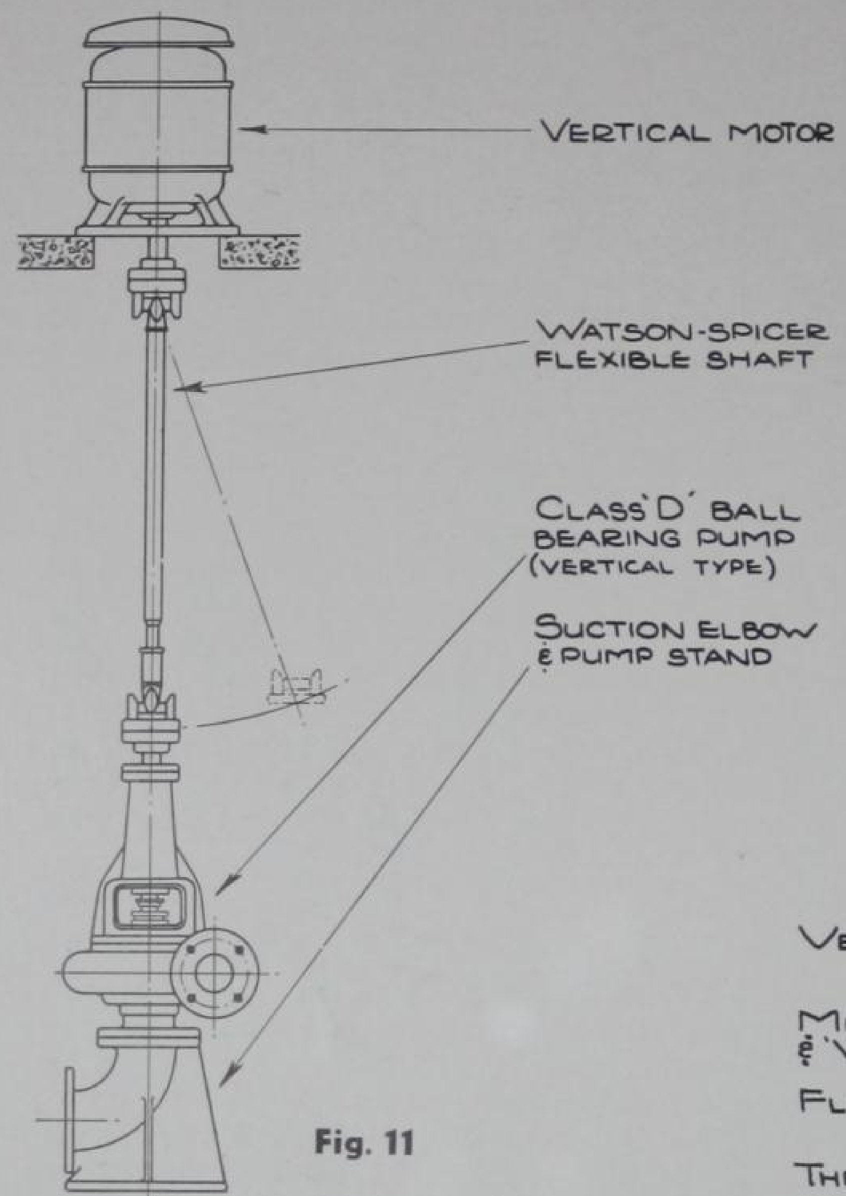


Fig. 11

Fig. 11 — The Automatic Type needle bearing flexible driving shaft handles misalignment up to 8 degrees, with an axial adjustment of from 3/16" to 1/2", depending upon size, taking care of expansion or contraction. One or more sections of shafting are used, according to the length required. When more than one section is used, one ball bearing pillow block is supplied with each intermediate section to carry the radial load. Inspection of pump is simplified by disconnecting at pump shaft and swinging the intermediate shaft out of the way, enabling pump cover with bearings and impeller to be removed as a unit from casing without disconnecting piping.

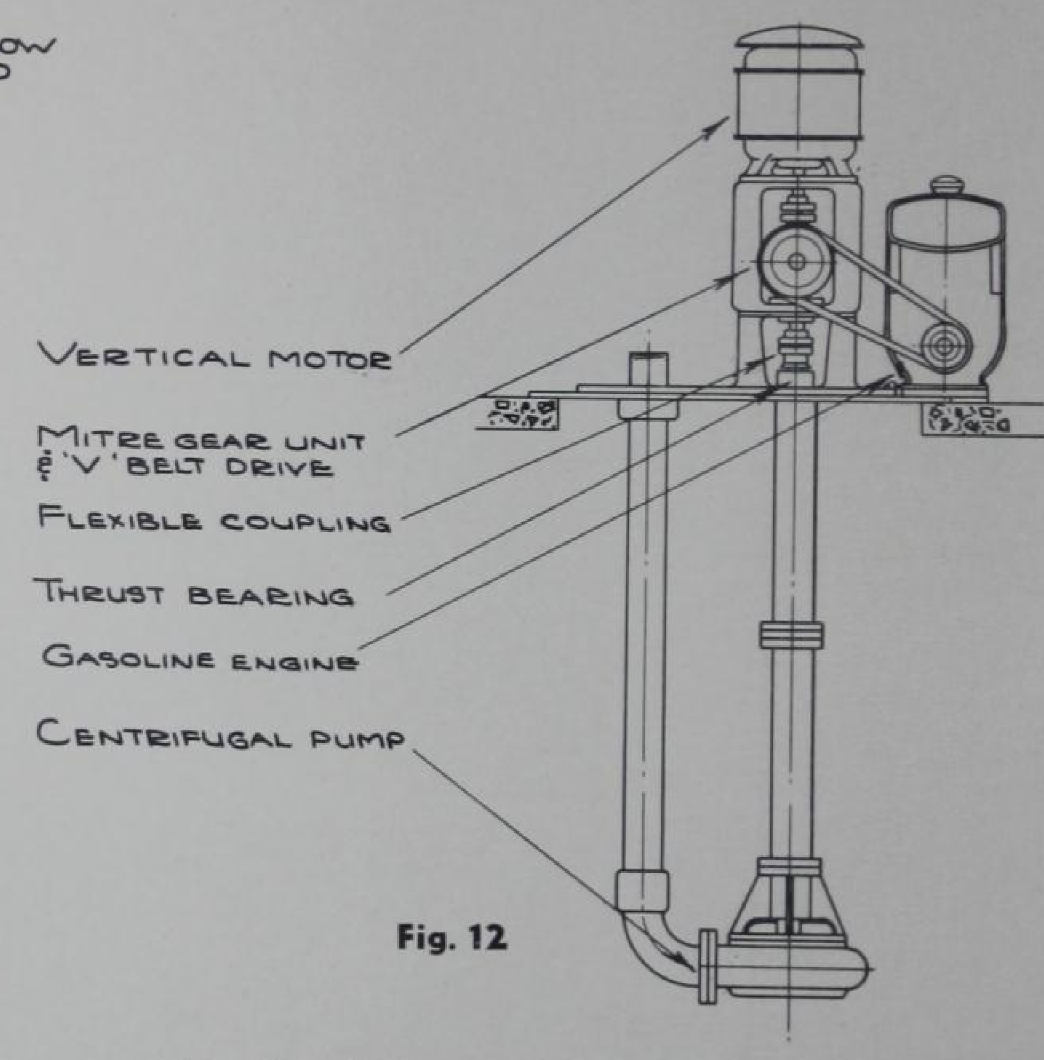


Fig. 12

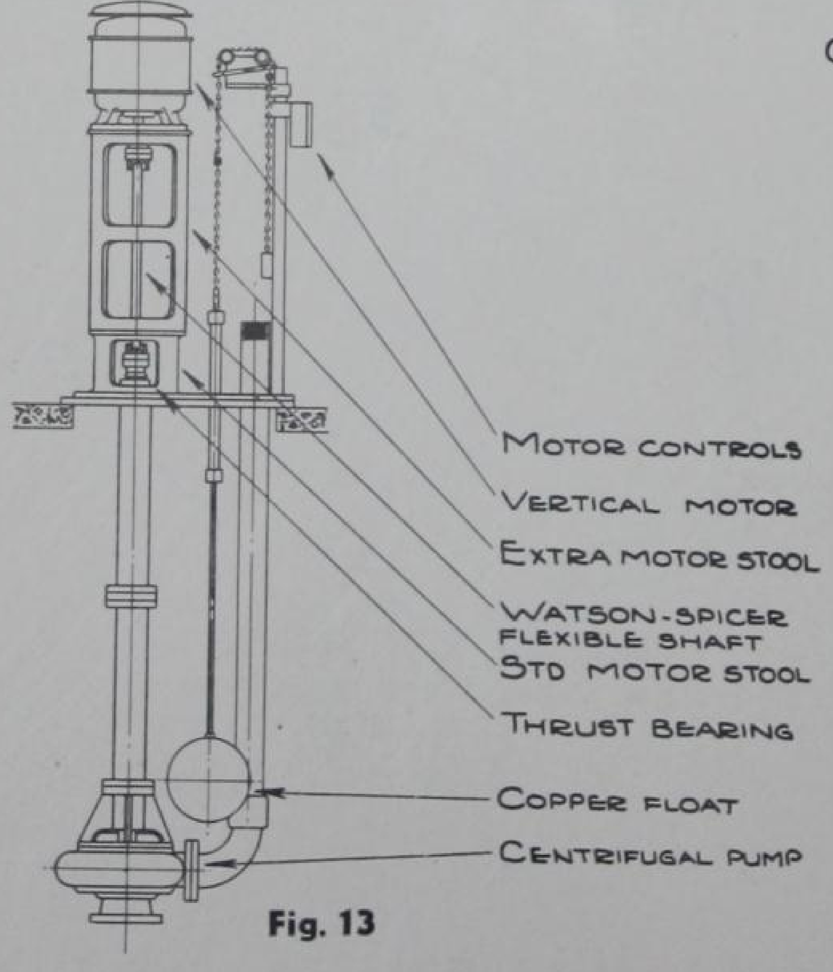
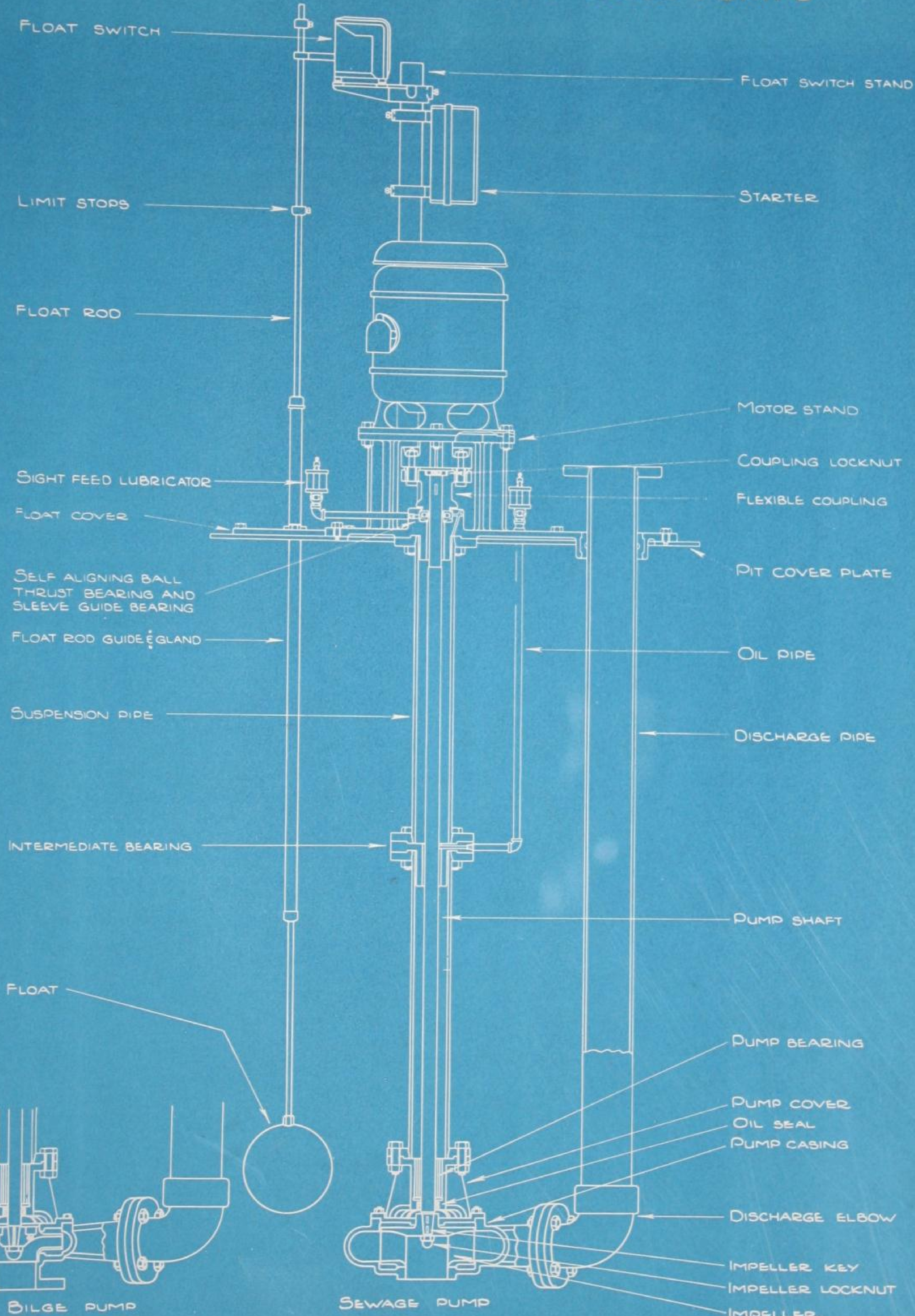


Fig. 13

Fig. 12 — In the event of power failure, an auxiliary drive can be furnished, either gasoline engine or turbine which would drive the vertical pump shaft through a right angle drive. We have installed many of these units for municipal and industrial service.

Fig. 13 — For certain installations where there is a possibility of power failure and consequent danger of motor and control equipment being damaged by flood water, the use of a raising piece to elevate motor beyond probable high water level is recommended. This equipment can be supplied with pump or at any time in the future.

PARTS LIST · SEWAGE AND BILGE PUMPS



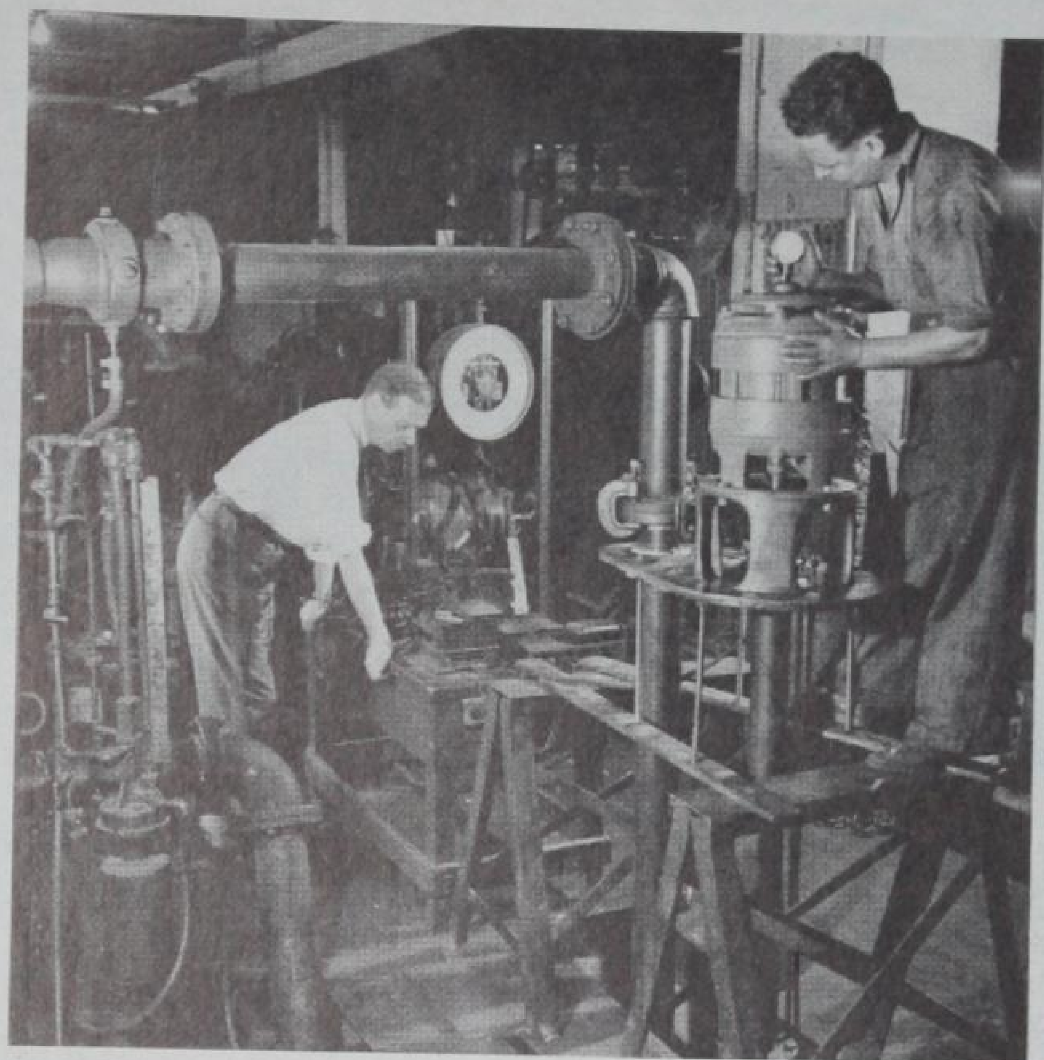
Partial List of Installations

Yeomans Darling Sewage and Bilge Pumps
Industrial, Public and Institutional Buildings

Alberta Nitrogen Co. Ltd.	Calgary, Alta.
Hudson's Bay Railway Building	Churchill, Man.
Cornwall Armories	Cornwall, Ont.
R.C.A.F. Aircraft Repair Depot	Dartmouth, N.S.
H.M.C.S. "Cornwallis", Naval Training School	Deep Brook, N.S.
T. Eaton Co. Limited	Edmonton, Alta.
Royal Canadian Navy Barracks	Esquimalt, B.C.
R.C.A.F. Airport	Gander, Nfld.
Post Office Building	Halifax, N.S.
Zellers Limited	Halifax, N.S.
Aluminum Co. of Canada, Limited	Kingston, Ont.
Dominion Engineering Works, Limited	Lachine, P.Q.
Hopital St. Joseph de Lachine	Lachine, P.Q.
Ayers Limited	Lachute Mills, P.Q.
Freres des Ecoles Chretiennes	Laval des Rapides, P.Q.
Hotel London	London, Ont.
La Municipalite Scolaire Catholique de Montreal	Longueuil, P.Q.
National Steel Car Corp., Limited	Malton, Ont.
Imperial Tobacco Company of Canada, Limited	Montreal, P.Q.
Canadian Car & Foundry Co., Limited, Turcot Plant	Mcntreal, P.Q.
Coca-Cola Co. of Canada, Limited	Montreal, P.Q.
Ogilvie Flour Mills Co., Limited	Montreal, P.Q.
Commercial Alcohols, Limited	Montreal, P.Q.
Mount Royal Hotel	Montreal, P.Q.
Dominion Rubber Company Limited	Montreal, P.Q.
Canadian Pacific Railway Garage	Montreal, P.Q.
Botanical Gardens	Montreal, P.Q.
Y.M.C.A.	Montreal, P.Q.
City of Montreal Comfort Stations	Montreal, P.
Rev. Soeurs Grises	Montreal, P.
Montreal Convalescent Home	Montreal, P.
Uplands Airport	Ottawa, On
Civic Workshops	Ottawa, On
Abattoir de Québec Inc.	Quebec, P.
Provincial Government Building	Quebec, P.
Rev. Peres Dominicains	Quebec, P.
Town of Lloydminster	Saskatchewa
Scarboro Township School	Scarboro, On
R.C.A.F. No. 4 Repair Depot	Scoudouc, N.
Marine Industries, Limited	Sorel, P.
Seminaire St. Jean	St. Jean, P.
Les Hotelleries A. Maurice Inc.	St. Jerome, P.
Bank of Nova Scotia	Saint John, N.
City of St. Hyacinthe	St. Hyacinthe, P.
R.C.A.F. No. 131 Service Flying Training Station	St. Hubert, P.
H. J. Heinz Company of Canada, Limited	Toronto, Ont
Canadian Breweries, Limited	Toronto, Ont
Globe and Mail Building	Toronto, Ont
Bank of Montreal	Toronto, Ont
St. Mary's Training School	Toronto, Ont
United States Army Project	The Pas, Man
Dominion Arsenal	Valcartier, P.Q
General Post Office	Vancouver, B.C
City of Windsor-Subway	Windsor, Ont
Winnipeg Free Press	Winnipeg, Man
Firestone Tire and Rubber Co. of Canada, Limited	Woodstock, Ont

EVERY YEOMANS DARLING PUMP FULLY TESTED

• A section of our Testing Department, where every Yeomans Darling Pump manufactured is subjected to a thorough test to ensure satisfactory operation under the conditions specified by the purchasor.



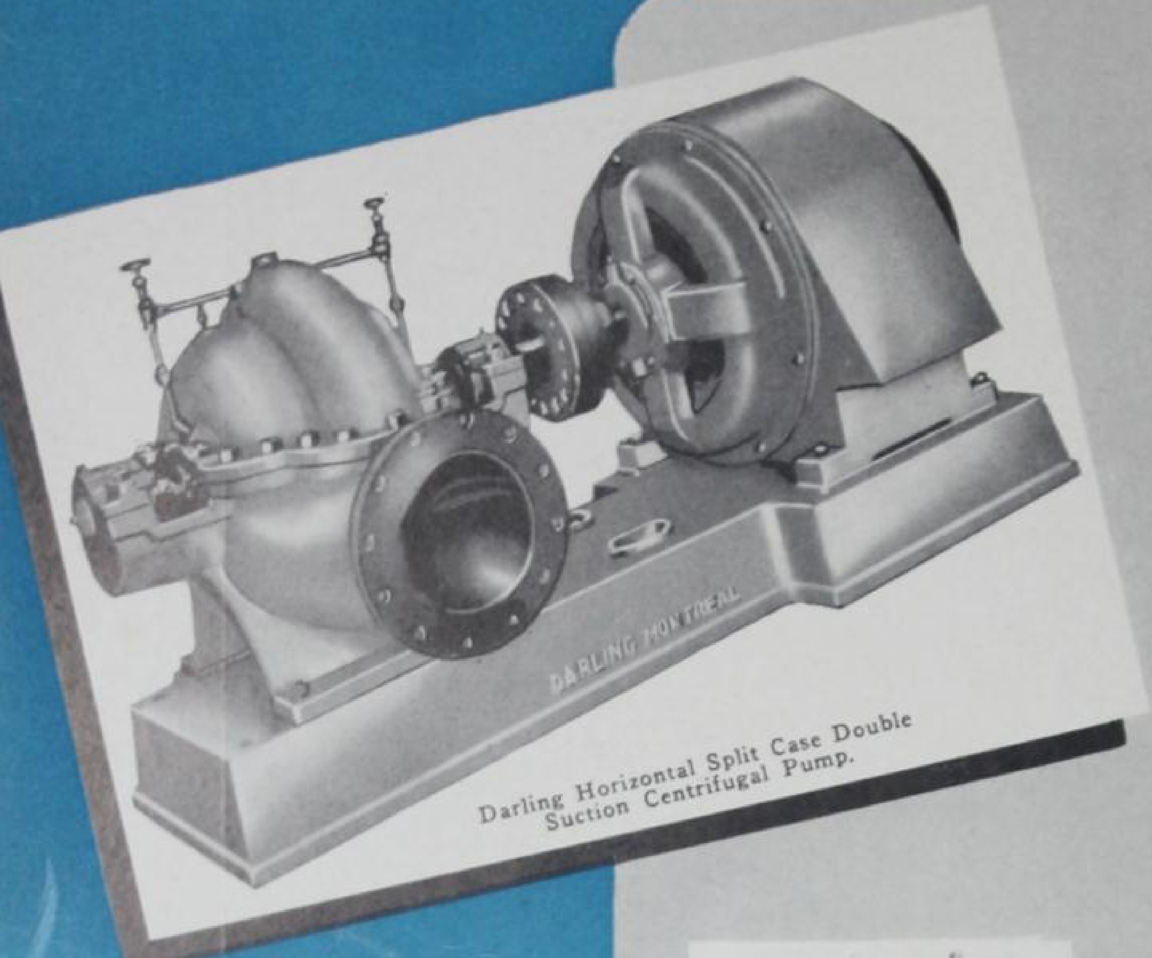
Testing Department

DARLING BROTHERS LIMITED

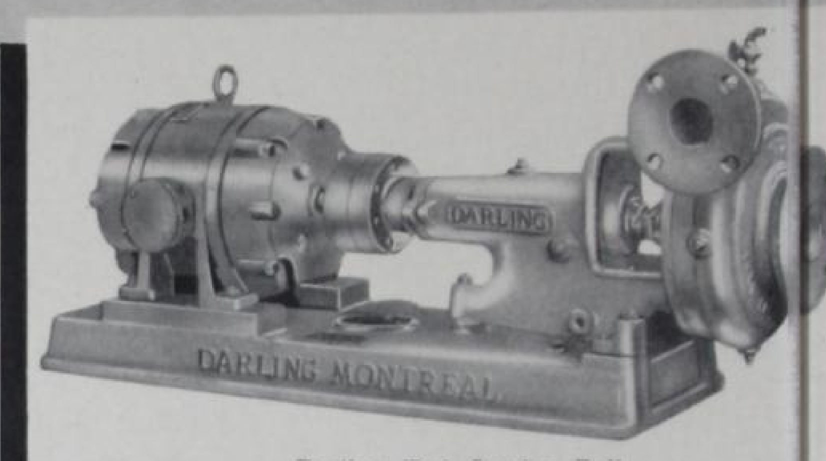
Branch Offices and Representatives

HALIFAX, N.S.	E. S. Stephenson & Co., Ltd.	155 Granville Street
SAINT JOHN, N.B.	E. S. Stephenson & Co., Ltd.	15 Dock Street
QUEBEC, P.Q.	W. J. Banks	140 St. John Street
ARVIDA, P.Q.	J. R. R. Beaudet	122 High Street
OTTAWA, ONT.	Darling Brothers Limited	18 Rideau Street
TORONTO, ONT.	Darling Brothers Limited	137 Wellington Street W.
WINNIPEG, MAN.	Darling Brothers Limited	123 Princess Street
CALGARY, ALTA.	H. F. Clarke & Co. Ltd.	1114 Fifth Street W.
VANCOUVER, B.C.	Frank Darling & Co. Ltd.	1144 Homer Street
ST. JOHN'S NFLD.	Clayton Construction Company	198 Water Street

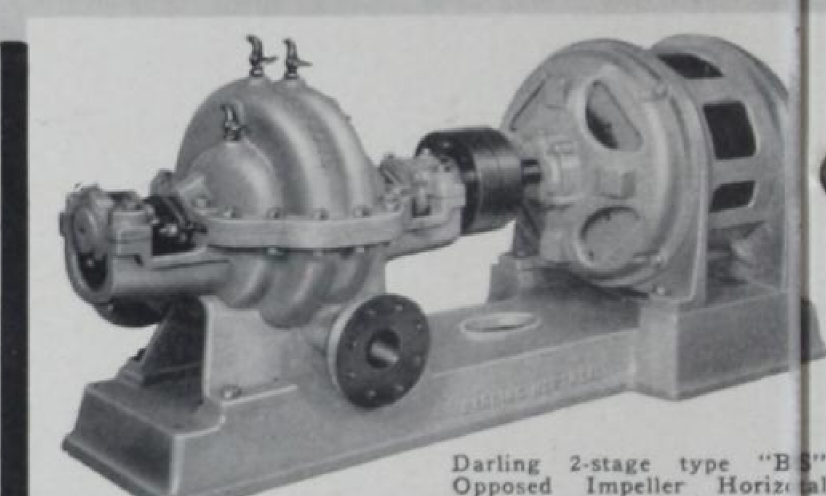
Other DARLING Centrifugal Pumps



Darling Horizontal Split Case Double Suction Centrifugal Pump.



Darling End Suction Ball Bearing Centrifugal Pump.



Darling 2-stage type "BS" Opposed Impeller Horizontal Centrifugal Pump.

WE ALSO MANUFACTURE THE FOLLOWING TYPES

Horizontal Split Case Double Suction Multi-Stage.

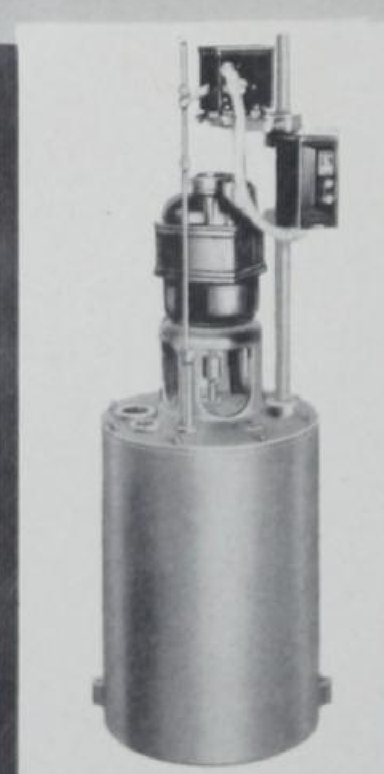
Horizontal Split Case Single Suction Multi-Stage.

Horizontal End Suction Two Stage Opposed Impeller.

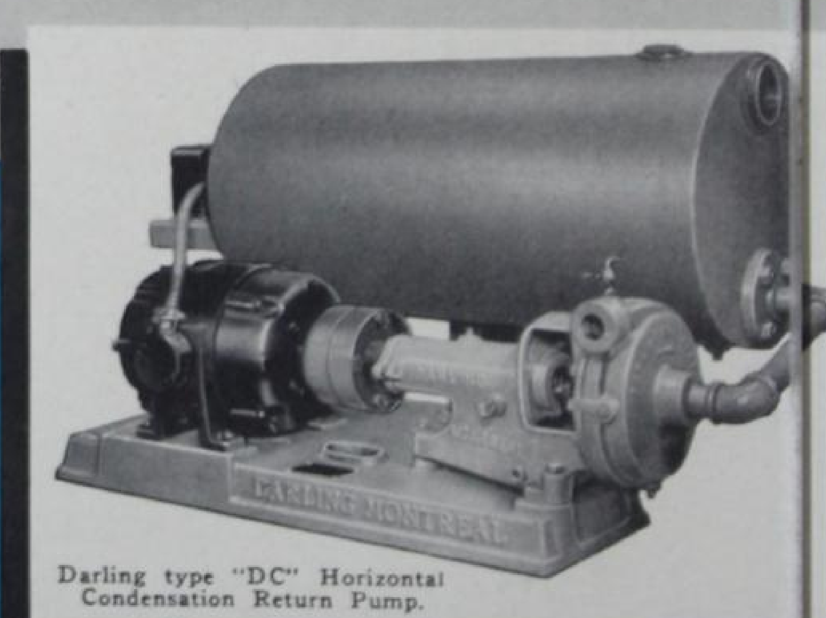
Horizontal Non-Clogging.

Vertical Electric Cellar Drainers.

Direct Acting Steam Pumps



Darling type "VC" Vertical Condensation Return Pump.



Darling type "DC" Horizontal Condensation Return Pump.

Darling Brothers Limited

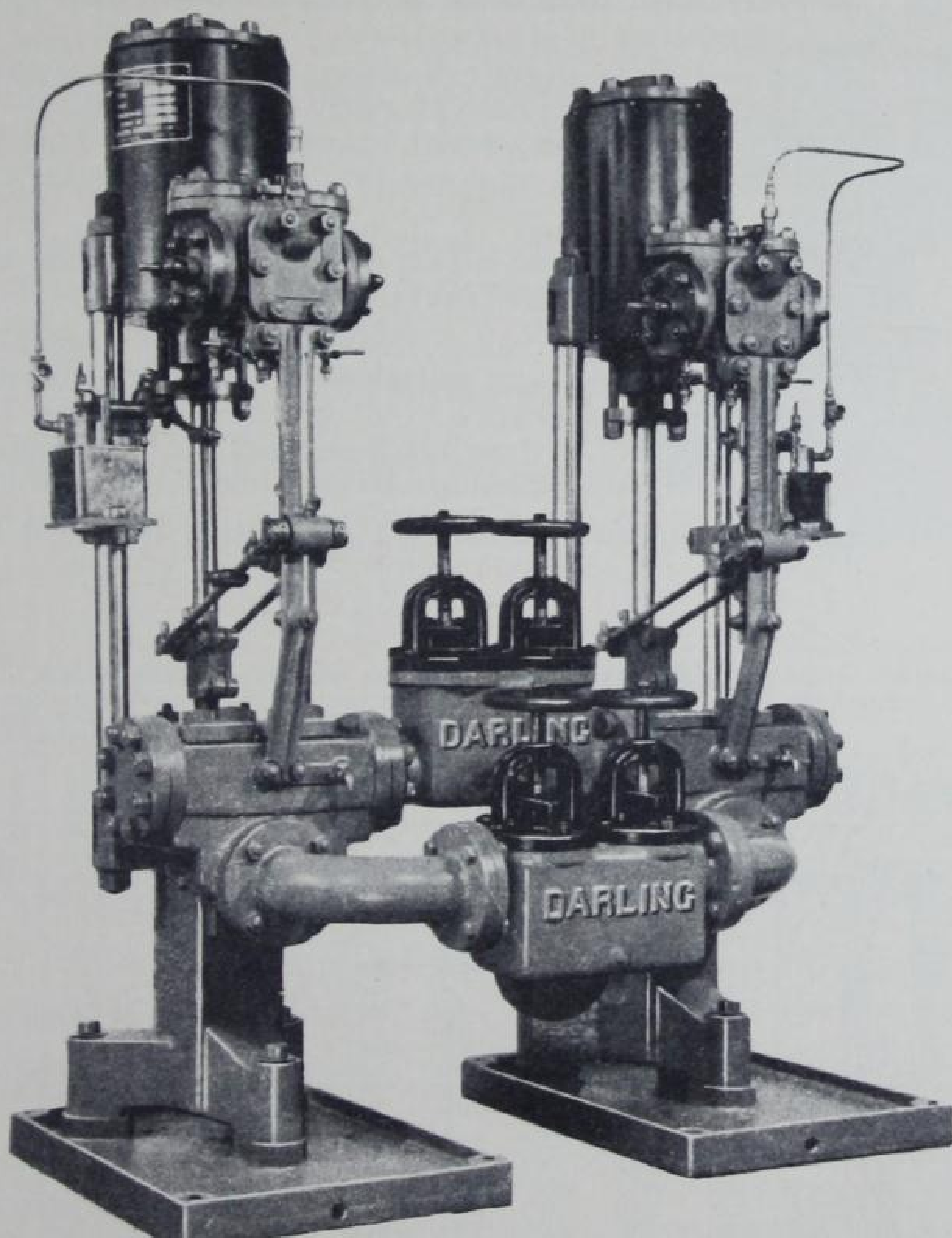
Head Office and Plant

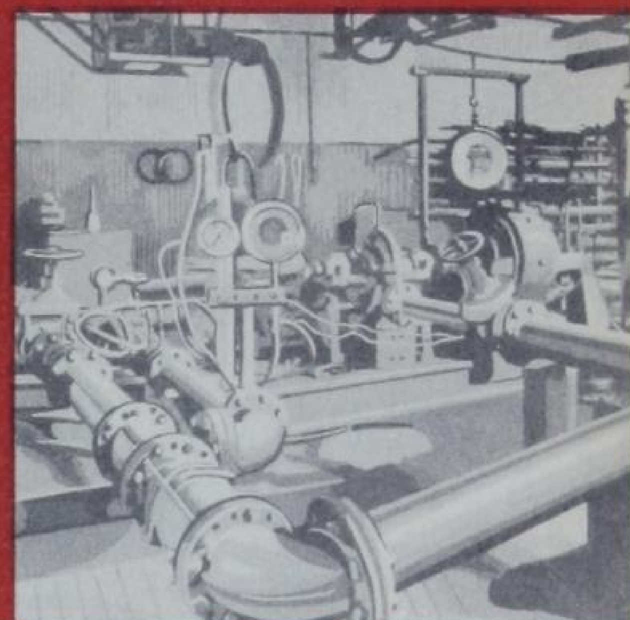
MONTREAL

Darling
STEAM PUMPS

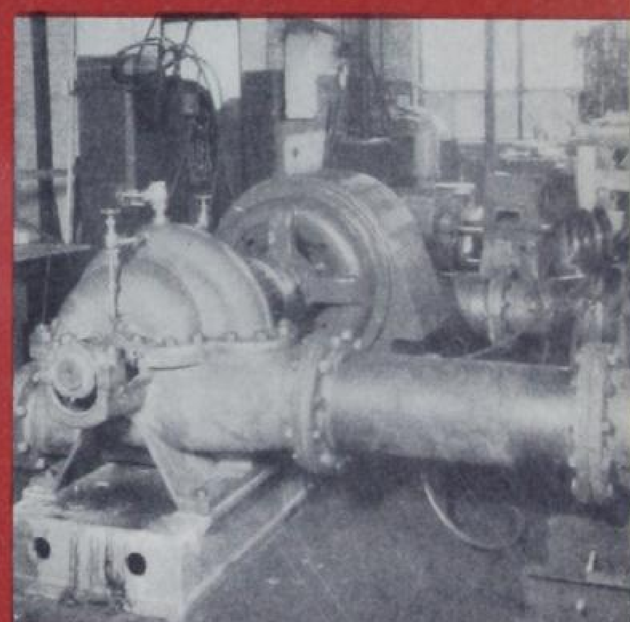
BULLETIN 44D

SINCE 1888

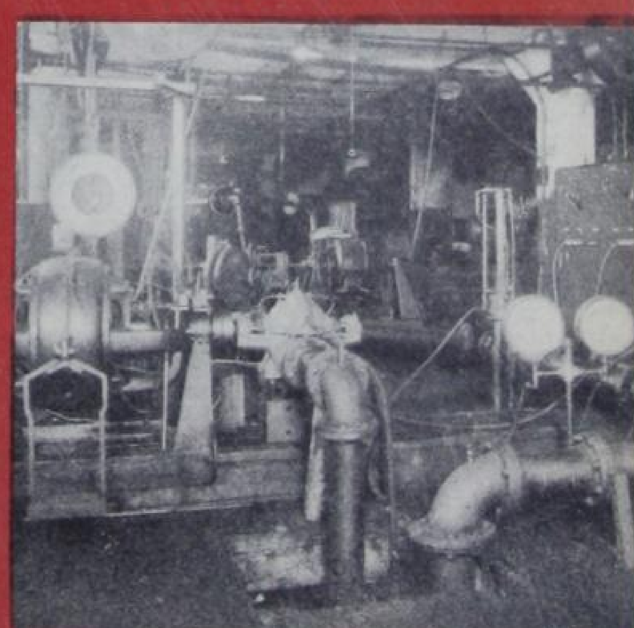




Dynamometer with Pump on Test



Direct Connected Motor Driven Centrifugal Pump on Test



Dynamometer Test and Control Panel

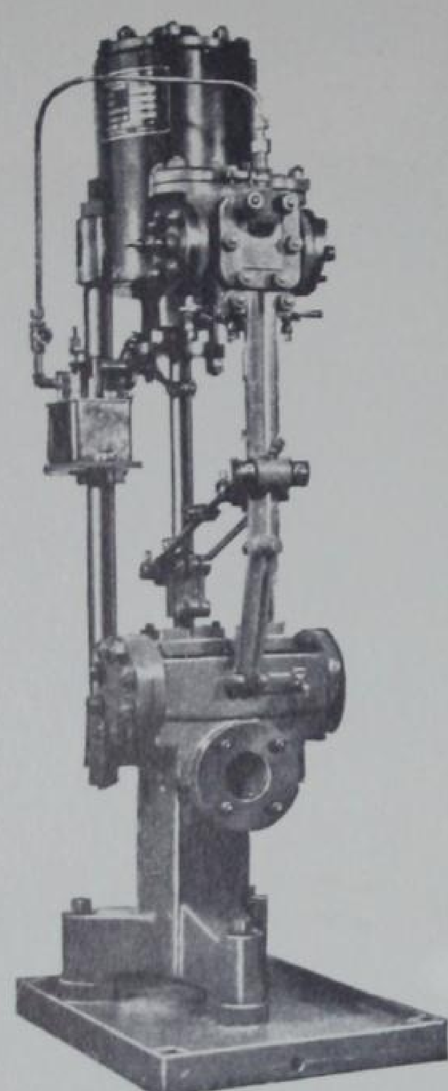
DARLING BROTHERS LIMITED
140 PRINCE ST. MONTREAL, CANADA

HALIFAX • SAINT JOHN • QUEBEC • ARVIDA • TIMMINS
OTTAWA • TORONTO • WINNIPEG • CALGARY • VANCOUVER • ST. JOHN'S, NFLD.

Carruthers-Darling Vertical Singlex Pumps

BOILER FEED AND GENERAL LAND OR MARINE SERVICE

220 Pounds Maximum Steam and Water Pressures



STANDARD SPECIFICATIONS

Steam Cylinder	Hard close-grained cast iron.
Pump End	Cast iron fitted with removable cast bronze liners and valve seats with spring loaded metallic disc valves.
Pistons	Steam Piston—Cast iron, with cast iron spring rings. Pump Piston—Bronze, fitted with two ebonite cut packing rings.
Rods	Steam Piston Rods—mild steel. Pump Rods—rolled bronze.
Steam Valve Gear	Bronze bushed with large working surfaces. Cold rolled steel used extensively in construction. The steam supply to the cylinders is controlled by a piston valve operated by a small pilot valve driven from the piston rod cross-head. Piston valve fitted with position indicator. The valve gear is positive in action, and can be regulated to make a constant length of stroke.
Standard Fittings	Comprise drain valves. Steam cylinders are insulated with magnesia and covered with planished sheet steel.
Extras	Steam and exhaust valves, relief valves, air vessels, pressure gauges, foundation bolts and washers, mechanical lubricators for steam cylinder lubrication, and cast iron drip ledge baseplate. Durabla Valves (for description see page 7). Bronze pump ends. Steam piston rods and pump rods in stainless steel or Monel metal.
Testing	All pumps are fully tested and test certificate can be furnished if desired.

CAPACITIES OF CARRUTHERS-DARLING VERTICAL SINGLEX BOILER FEED AND GENERAL SERVICE PUMPS IN U.S. G.P.M.

Size	U.S. Gals. per Stroke		Single Strokes Per Minute: Boiler Feeding 20	25	30	35	40	General Service 45	50	Intermittent Service 55	60	65	70	75	80	Size Pipe Connections: Steam	Exhaust	Suction	Discharge
6 x 4 x 12	.580	Boiler H.P.	192	241	289	337	386	434	482	530	578	626	674	723	771	¾	1	2½	2
		U.S.G.P.M.	11.6	14.5	17.4	20	23	26	29	32	35	37.8	40.6	43.5	46.5				
7 x 5 x 12	.966	Boiler H.P.	320	401	481	561	641	721	801	881	961	1041	1121	1201	1281	1	1¼	3	2½
		U.S.G.P.M.	19	24	29	34	39	43	48	53	58	63	68	72	77				
8 x 6 x 15	1.757	Boiler H.P.	583	729	875	1021	1166	1312	1458	1604	1750	1896	2041	2187	2333	1¼	1½	3	2½
		U.S.G.P.M.	35	44	53	62	70	79	88	96	105	114	123	132	141				
8 x 6 x 18	2.108	Boiler H.P.	700	875	1050	1225	1400	1575	1750	1925	2100	2275	2450	2625	2800	1¼	1½	3	2½
		U.S.G.P.M.	42	53	63	74	84	95	105	116	126	137	148	158	169				
9 x 6½ x 18 *11 x 6½ x 18	2.463	Boiler H.P.	817	1022	1226	1431	1635	1840	2044	2248	2453	2657	2862	3066	3271	1½	2	3½	3
		U.S.G.P.M.	49	61	74	86	98	111	123	135	148	160	172	185	197				
10 x 7 x 18	2.861	Boiler H.P.	950	1187	1424	1662	1900	2132	2374	2612	2849	3087	3324	3562	3799	1½	2	4	3½
		U.S.G.P.M.	57	71	86	100	114	129	143	157	172	186	200	214	229				
11 x 8 x 21 *13 x 8 x 21	4.367	Boiler H.P.	1450	1812	2174	2537	2900	3262	3624	3987	4349	4712	5074	5437	5799	1½	2	5	4
		U.S.G.P.M.	87	109	131	153	175	196	218	240	262	284	306	327	349				
12 x 9 x 24	6.607	Boiler H.P.	2193	2742	3290	3838	4387	4935	5483	6032	6580	7129	7677	8225	8774	2	2½	5	4
		U.S.G.P.M.	132	165	198	230	264	297	330	363	396	429	462	495	528				
14 x 10 x 24	8.160	Boiler H.P.	2709	3386	4063	4741	5418	6095	6772	7450	8127	8804	9482	10,159	10,836	2	2½	6	5
		U.S.G.P.M.	163	204	245	285	326	367	408	449	489	530	571	612	653				
16 x 12 x 24	11.740	Boiler H.P.	3897	4872	5846	6821	7795	8770	9744	10,719	11,690	12,668	13,642	14,617	15,591	2	2½	6	5
		U.S.G.P.M.	234	293	352	411	470	528	587	646	704	763	822	880	939				

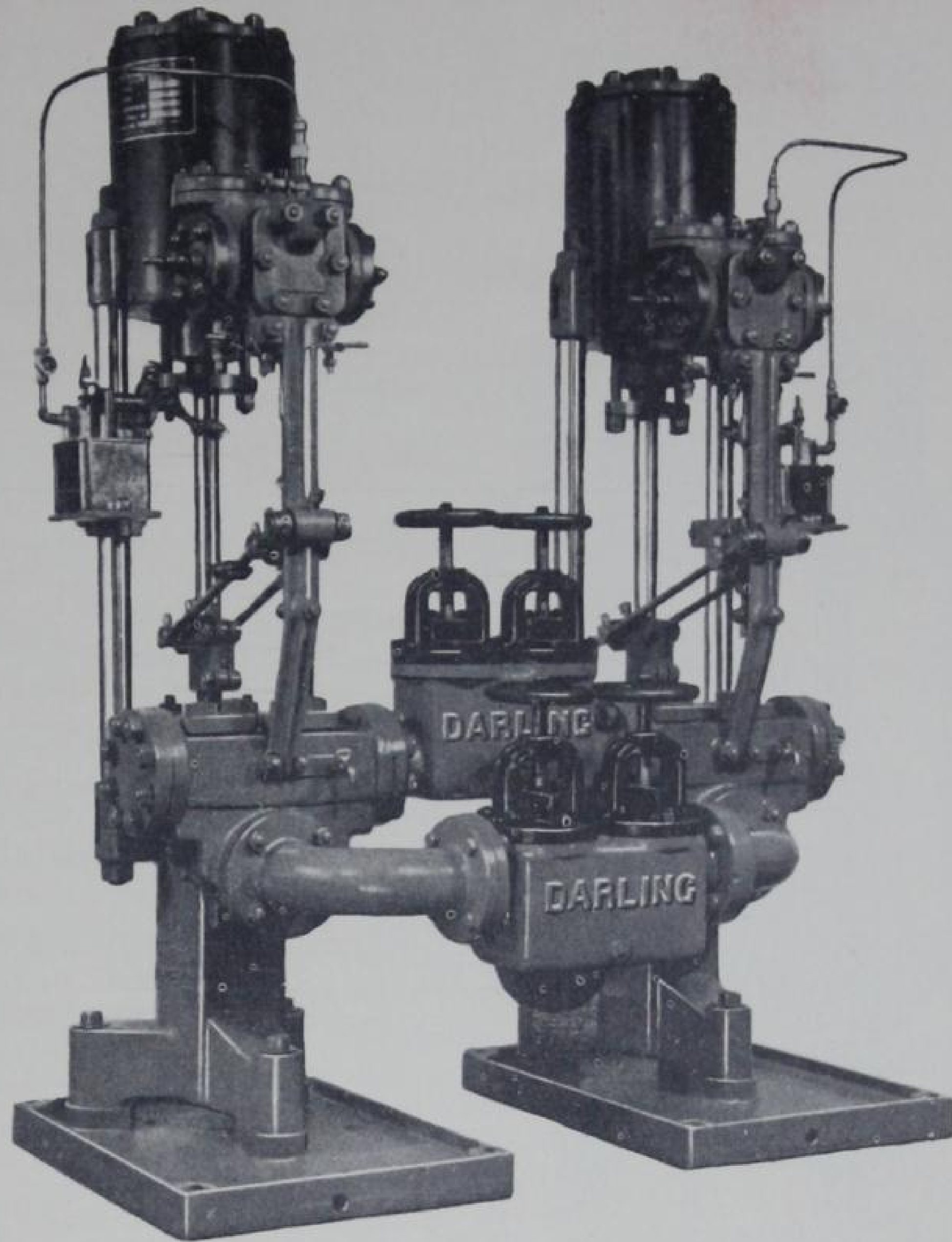
30 Pounds or 3.6 U.S. Gallons of water per Horsepower per hour, evaporated from 100° F. to 70 Pounds Steam Pressure per square inch.
All Connections are Flanged.

* Note: Use larger diameter steam cylinder when operating with Water Line controls.
Other ratios available on request.

Twin Feed Pumps

MODERN Power Plants usually have two Feed Pumps, and for convenient operation we can supply steam manifolds, and suction and discharge manifolds.

The illustration shows Twin Feed Pumps with suction and discharge manifolds, mechanical lubricators, cast iron drip ledge baseplates. In general with this arrangement, only one pump is in commission at a time, the other serving as a spare, and the changing over from one pump to the other is quickly and easily accomplished. This is a very desirable arrangement where continuous service is required.



Carruthers-Darling Vertical Singlex Twin Feed Pump

Recommended Spares for

VERTICAL SINGLEX PUMPS (Page 2)

One full set of pump valves and springs.
Packing rings for one steam piston.
Packing rings for one pump piston.

★

Additional Spares

One steam piston with rod and nut.
One pump piston with rod and nut.
One suction and one delivery valve seat.
One suction and one delivery valve guard.

VERTICAL DUPLEX PUMPS (Pages 4 and 5)

One full set of pump valves and springs.
Packing rings for two steam pistons.
Packing rings for two pump pistons.

★

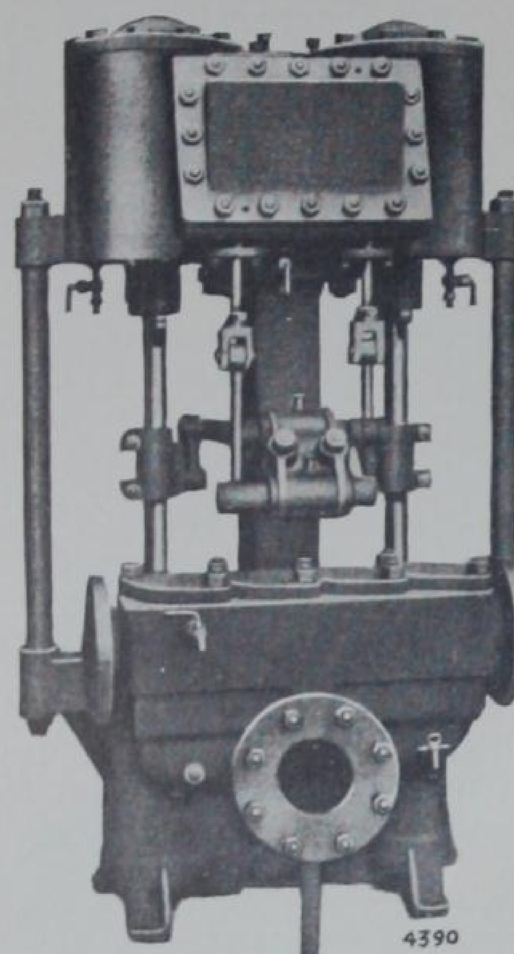
Additional Spares

One steam piston with rod and nut.
One pump piston with rod and nut.
Two suction and two delivery valve seats.
Two suction and two delivery valve guards

Carruthers - Darling Vertical Duplex Pumps

BOILER FEED AND GENERAL LAND OR MARINE SERVICE

220 Pounds Maximum Steam and Water Pressures



STANDARD SPECIFICATION

STEAM CYLINDERS	Hard close-grained cast iron.
PUMP ENDS	Cast iron and fitted with removable cast bronze liners and valve seats with spring loaded metallic disc valves.
PISTONS	Steam Pistons—Cast iron, with cast iron spring rings. Pump Pistons—Bronze, fitted with two ebonite cut packing rings.
RODS	Steam Piston Rods—mild steel. Pump Rods—rolled bronze.
STEAM VALVE GEAR	Bronze bushed with large working surfaces. Shaft bushes are adjustable. Actuating levers and rock shafts cast of steel in one piece.
STANDARD FITTINGS	Comprise drain valves. Steam cylinders are insulated with magnesia and covered with planished sheet steel.
EXTRAS	Steam and exhaust valves, relief valves, air vessels, pressure gauges, foundation bolts and washers, mechanical lubricators for steam cylinder lubrication and cast iron drip ledge base-plate. Durabla valves (for description see page 7). Bronze pump ends. Steam piston rods and pump rods in stainless steel or Monel metal.
TESTING	All pumps are fully tested and test certificate can be furnished if desired.

CAPACITIES OF CARRUTHERS-DARLING VERTICAL DUPLEX BOILER FEED AND GENERAL SERVICE PUMPS IN U.S.G.P.M.

Size	U.S. Gals. per Stroke		Single Strokes Each Side Per Minute: Boiler Feed and Fuel Oil 20	25	30	35	40	50	60	General Service 70	80	90	Intermittent Service 100	110	120	Size Pipe Connections: Steam	Exhaust	Suction	Discharge	Weight
4½ x 3 x 5	.139	Boiler H.P.	92	117	140	167	185	234	284	324	370	416	468	519	560	¾	1	2½	2	680
		U.S.G.P.M.	5.5	7	8.4	10	11	14	17	19.5	22	25	28	31	33.5					
5½ x 3½ x 6	.225	Boiler H.P.	150	189	225	267	300	378	452	528	600	675	750	830	900	1	1½	3	2½	870
		U.S.G.P.M.	9	11.3	13.5	16	18	22.6	27	31.6	36	40.8	45	49.7	54					
6 x 4 x 6	.298	Boiler H.P.	200	250	300	350	400	500	600	700	800	900	1000	1100	1200	1	1¼	3	3	1000
		U.S.G.P.M.	12	15	18	21	24	30	36	42	48	54	60	66	72					
6 x 4¼ x 7	.396	Boiler H.P.	266	332	398	466	533	666	789	920	1052	1184	1315	1446	1578	1	1¼	3½	3	1100
		U.S.G.P.M.	16	20	24	28	32	40	48	56	64	72	80	88	96					
7 x 5 x 8	.612	Boiler H.P.	406	508	610	712	813	1017	1220	1423	1627	1830	2035	2237	2441	1¼	1½	4	3½	1350
		U.S.G.P.M.	24.5	31	37	43	49	61	74	86	98	110	122	135	147					
8 x 5¾ x 9	.998	Boiler H.P.	663	828	994	1160	1325	1657	1988	2320	2651	2983	3314	3646	3977	1½	2	5	4	1450
		U.S.G.P.M.	40	50	60	70	80	100	120	140	160	180	200	220	240					
9 x 6½ x 10	1.315	Boiler H.P.	873	1091	1309	1528	1746	2183	2619	3056	3492	3929	4365	4802	5239	1¾	2	5	4	2200
		U.S.G.P.M.	53	66	79	92	105	131	158	184	210	237	263	289	315					
10 x 7 x 10	1.523	Boiler H.P.	1011	1264	1516	1769	2022	2528	3033	3539	4045	4550	5056	5562	6067	2	2½	6	5	2400
		U.S.G.P.M.	61	76	92	107	122	152	183	214	244	275	305	336	366					
10 x 7½ x 12	2.047	Boiler H.P.	1359	1682	2038	2378	2718	3398	4077	4757	5436	6116	6796	7475	8155	2	2½	6	5	3000
		U.S.G.P.M.	82	102	123	143	164	204	245	286	327	369	410	450	490					
12 x 8 x 12	2.458	Boiler H.P.	1632	2040	2448	2857	3265	4081	4897	5714	6530	7346	8162	8979	9795	2½	3	6	5	3650
		U.S.G.P.M.	98	123	147	172	196	246	294	344	392	442	492	541	588					
14 x 9 x 12	3.073	Boiler H.P.	2040	2550	3060	3570	4080	5100	6120	7140	8160	9180	10,200	11,220	12,240	3	3½	6	6	4000
		U.S.G.P.M.	123	154	184	215	246	308	368	430	492	553	616	676	736					
14 x 10 x 15	4.563	Boiler H.P.	3030	3787	4545	5302	6060	7575	9090	10,605	12,120	13,636	15,151	16,666	18,181	3	3½	8	6	5300
		U.S.G.P.M.	182	228	273	319	364	456	546	638	728	821	912	1004	1092					
15 x 11 x 15	5.740	Boiler H.P.	3811	4764	5717	6670	7623	9529	11435	13,341	15,247	17,153	19,059	20,965	22,871	3	3½	8	8	6000
		U.S.G.P.M.	230	287	344	401	460	574	688	802	920	1033	1148	1263	1376					

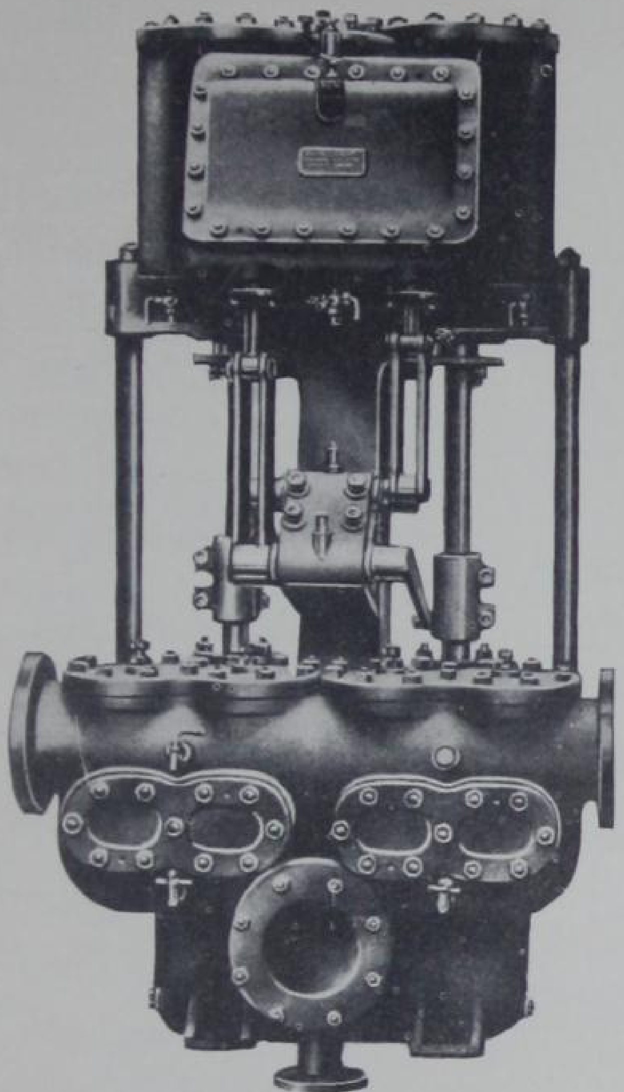
30 pounds or 3.6 U.S. Gallons of water per horsepower per hour from 100° F. to 70 pounds steam pressure per square inch.
All Connections are Flanged.

Carruthers-Darling Vertical Duplex Pumps

BALLAST, BILGE, SANITARY AND LOW SERVICE

220 Pounds Maximum Steam Pressure

90 Pounds Maximum Water Pressure



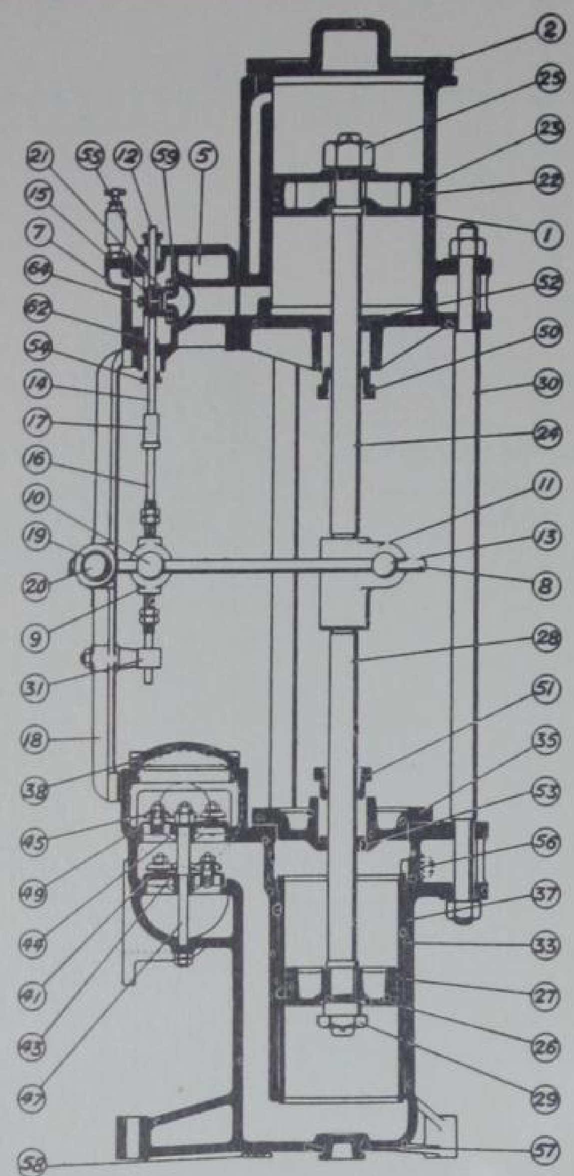
STANDARD SPECIFICATION

STEAM CYLINDERS	Hard close-grained cast iron.
PUMP ENDS	Cast iron and fitted with removable cast bronze liners and valve seats with spring loaded metallic disc valves.
PISTONS	Steam Pistons—Cast iron, with cast iron spring rings. Pump Pistons—Bronze, fitted with suitable packing for the service desired.
RODS	Steam Piston Rods—mild steel. Pump Rods—rolled bronze.
STEAM VALVE GEAR	Bronze bushed with large working surfaces. Shaft bushes are adjustable. Actuating levers and rock shafts are cast of steel in one piece.
STANDARD FITTINGS	Comprise air and drain valves, test cocks, steam cylinders are insulated with magnesia and covered with planished sheet steel.
EXTRAS	Steam and exhaust valves, relief valves, air vessels, pressure gauges, foundation bolts and washers, mechanical lubricators for steam cylinder lubrication and cast iron drip ledge baseplate. Durabla valves (for description see page 7). Bronze pump ends. Steam piston rods and pump rods in stainless steel or Monel metal.
TESTING	All pumps are fully tested and test certificate can be furnished if desired.

CAPACITIES OF CARRUTHERS-DARLING VERTICAL LOW-SERVICE DUPLEX PUMPS IN U.S.G.P.M.

Size	U.S. Gals. per Stroke Each Side	Single Strokes each side per Minute														Size Pipe Connections				Weight
		Continuous Service									Intermittent Service					Ballast	Steam	Exhaust	Suction	Discharge	
		20	25	30	35	40	50	60	70	80	90	100	110	120	130	140	150					
4½ x 4½ x 5	.3227	13	16	19	22	26	32	38	45	52	58	64	71	77	84	90	97	¾	1	3½	3	800
5½ x 5½ x 6	.5852	23	29	35	41	46	58	70	82	94	105	117	129	140	152	164	176	1	1¼	4	3½	1050
6 x 6 x 6	.6958	28	35	42	49	56	70	84	98	112	126	140	154	168	182	196	210	1	1¼	4½	4	1250
6 x 7 x 7	.9914	40	50	60	70	80	100	119	139	159	179	198	218	238	258	278	298	1	1¼	5	5	1350
7 x 8½ x 8	1.8933	76	94	113	132	152	189	228	266	304	341	378	416	454	492	530	569	1¼	1½	6	5	2000
8 x 9 x 9	2.3977	96	120	144	168	192	240	288	336	384	432	480	528	576	624	672	720	1½	2	6	6	2300
9 x 10 x 10	3.2958	132	165	198	231	264	330	396	462	528	594	660	726	792	858	924	990	1¾	2	8	6	2800
10 x 11 x 10	4.0098	160	200	240	280	320	400	480	560	640	720	800	880	960	1040	1120	1200	2	2½	8	8	3200
10 x 12 x 12	5.7318	229	286	343	400	458	572	686	800	916	1030	1144	1258	1372	1486	1600	1720	2	2½	8	8	4000
12 x 13 x 15	8.092	323	404	484	565	646	808	968	1130	1292	1453	1615	1775	1935	2100	2360	2420	2½	3	10	8	4550
14 x 15 x 15	10.831	433	542	650	759	867	1083	1300	1515	1735	1950	2117	2380	2600	2820	3035	3250	2½	3	12	10	5800

All connections are flanged



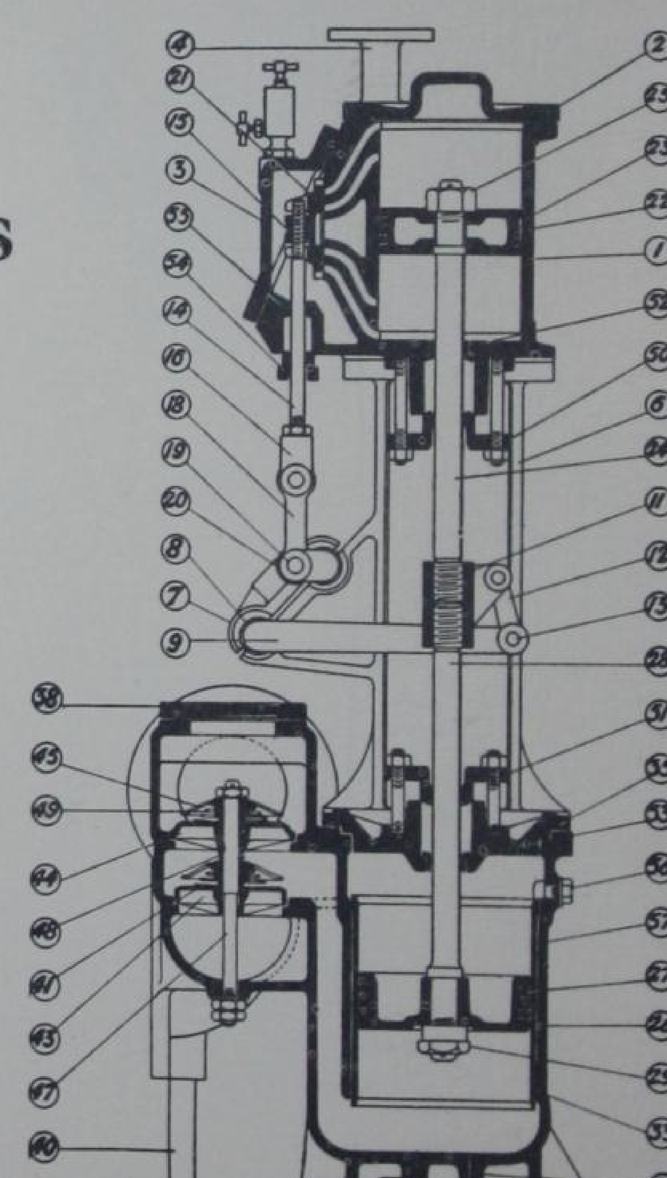
Carruthers - Darling Pumps

Vertical Singlex Type

PART LIST

1 Cylinder
2 Cylinder Cover
5 Piston Valve Casing
6 Valve Casing End Covers
7 Valve Casing Front Cover
8 Valve Gear Levers
9 Valve Gear Crosspiece
10 Valve Gear Sliding Pin
11 Crosshead
12 Pilot Valve Sp. Tail Piece
13 Crosshead Pin
14 Pilot Valve Spindle
15 Pilot Valve Spindle Nut
16 Operating Rod
17 Valve Spindle Coupling
18 Front Stay
19 Fulcrum Bush.
20 Fulcrum Pin
21 Pilot Valve
22 Steam Piston
23 Steam Piston Rings
24 Steam Piston Rod
25 Steam Piston Rod Nut
26 Pump Piston
27 Pump Piston Rings
28 Pump Piston Rod
29 Pump Piston Rod Nuts
30 Side Stays
31 Operating Rod Guide
33 Pump
35 Pump Cover
37 Pump Liner
38 Pump Chest Covers
41 Valves (Kinghorn)
43 Valve Seats (Suct.)
44 Valve Seats (Disch.)
45 Valve Guards (Kinghorn)
47 Valve Studs
49 Valve Springs
50 Steam Piston Rod Gland
51 Pump Piston Rod Gland
52 Steam Piston Rod Neck Ring
53 Pump Piston Rod Neck Ring
54 Valve Spindle Glands
55 Valve Spindle Neck Ring (Top)
56 Liner Locking Bolt
57 Pump Plug
58 Pump Pocket Plug
59 Piston Valve
60 Piston Valve End Spindle Gland
61 Piston Valve End Spindle Neck Bush.
62 Valve Spindle Neck Ring (Bott.)
63 Piston Valve End Spindles
64 Set Screw for Valve Spindle Nut
65 Spring for Valve Spindle Nut

Serial number and size of pump should be given when ordering spare parts



Carruthers - Darling Pumps

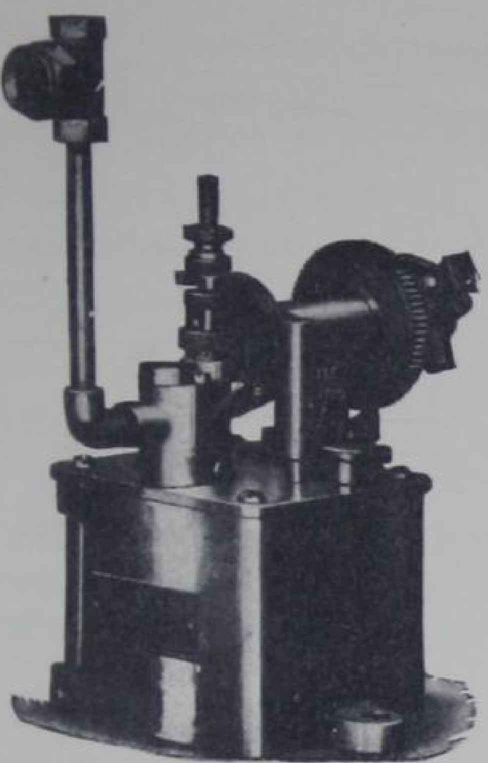
Vertical Duplex Type

PART LIST

1 Cylinder
2 Cylinder Cover
3 Casing Cover
4 Steam Stool
6 Column
7 Bracket Cover
8 Bracket Bush.
9 Wyper Shaft (Long)
10 Wyper Shaft (Short)
11 Crosshead
12 Crosshead Links
13 Crosshead Link Pins
14 Valve Spindle
15 Valve Spindle Nuts
16 Valve Spindle Forks
17 Valve Spindle Links (Long)
18 Valve Spindle Links (Short)
19 Valve Spindle Link Pins
20 Valve Spindle Link Bushes
21 Slide Valve
22 Steam Piston
23 Steam Piston Rings
24 Steam Piston Rod
25 Steam Piston Rod Nut
26 Pump Piston
27 Pump Piston Rings
28 Pump Piston Rod
29 Pump Piston Rod Nuts
33 Pump
35 Pump Cover
37 Pump Liner
38 Pump Chest Cover
40 Pump Stool
41 Valves (Kinghorn)
43 Valve Seats (Suct.)
44 Valve Seats (Disch.)
45 Valve Guards (Kinghorn)
47 Valve Stud
48 Valve Stud Springs
49 Valve Spring
50 Steam Piston Rod Gland
51 Pump Piston Rod Gland.
52 Steam Piston Rod Neck Ring
53 Pump Piston Rod Neck Ring
54 Valve Spindle Gland
55 Valve Spindle Neck Ring
56 Liner Locking Bolt
57 Pump Plug

Serial number and size of pump should be given when ordering spare parts

LUBRICATORS

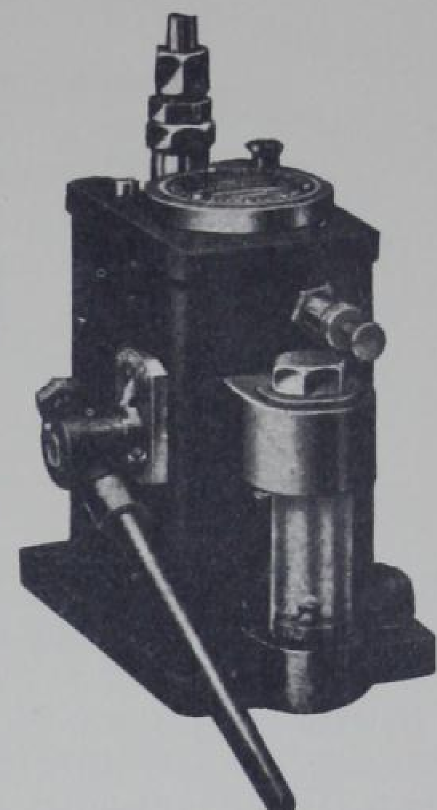


Hills-McCanna Single Feed Metal Body Type Force Feed Lubricator 2-Pint Size

THE mechanical type of lubricator is a valuable accessory for use with steam pumps. Once set they supply a metered quantity of oil (proportionate to speed of pump), to the steam cylinders. They save oil and insure continuous lubrication of the equipment.

We illustrate two different makes of lubricators. The Hills-McCanna two-pint ratchet drive, single feed, duco finish lubricator, fitted with blinker sight feed to give operator visible evidence that oil has left the pumping unit. Vacuum check valves are also included to be placed in the oil line between the lubricator and the pump cylinder. Larger capacities and nickel-plated finish are also available. Detailed information will be furnished on request.

The Dunbar & Slater one-pint size duco finish is suitable for use with small size steam pumps. Included with this unit are also suitable sight feed and check valve.



Dunbar & Slater "Standard" Force-Feed Lubricator No. 6DD. 1-Pint Size

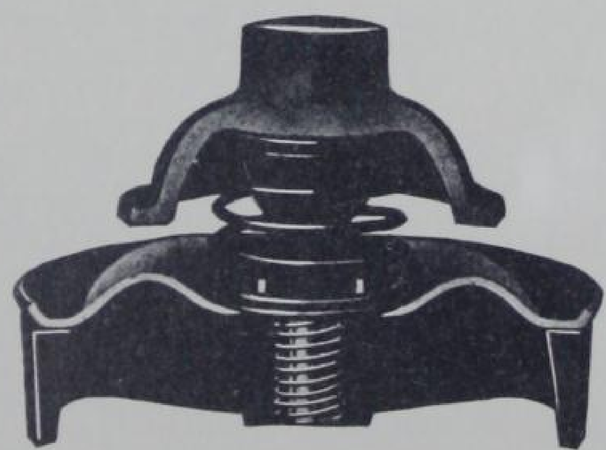
★

Durabla Metal Pump Valves

These Valves differ from cast or forged valves in that they are die formed from special thin non-corrosive metal alloy sheets, rolled and heat-treated for this purpose.

DURABLA Valves are the *lightest* and *strongest* valves made.

DURABLA Valves make contact only at the inner and outer areas of the valve seats. The arched design prevents warping and greatly adds to the strength.



With Guard-stem Style No. 402 Patent No. 1,681,364

all valve seats which have suitable diameters for the valves; in any type of Reciprocating Pump, Gas Engine, Gas Compressor, or Air Compressor; for any type of service (water, oil, gas, air and acid); and at any temperature and at any pressure.

DURABLA Valves maintain their efficiency continuously.

When making specifications for new pumps, or valve replacements, be sure to specify "DURABLA METAL PUMP VALVES."

DURABLA METAL PUMP VALVE SERVICE, as shown above, consists of Valve, Guard-stem, Spring, and Seat.

DURABLA METAL VALVES can be installed on

★

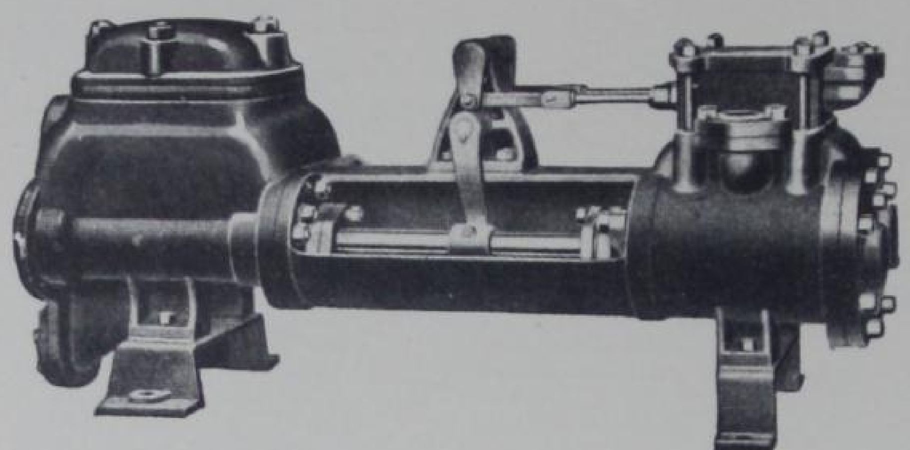
Note: DURABLA METAL PUMP VALVE SERVICE will increase general pumping efficiency and decrease maintenance costs.

Darling Horizontal Duplex Pumps

BOILER FEED OR GENERAL SERVICE

150 Pounds Maximum Steam Pressure

★



150 Pounds Maximum Water Pressure

★

THE pump illustrated above shows our standard high pressure duplex packed piston, valve plate type with end suction. Size 5¼″ x 3½″ x 5″ and smaller are constructed with steam cylinder, yoke and water cylinder cast in one piece. The pump is heavily constructed and all parts are interchangeable.

We regularly furnish cast iron water pistons and followers with bronze cylinder linings. The piston rods are of bronze unless otherwise ordered. The water end is fitted with bronze valve seats, valve bolts and springs, with either hard rubber, soft rubber or bronze valves, as the service may require. Steel rods and all iron fitted water ends can be supplied when required. Pumps can be fitted with air chambers at extra cost.

NOTE: DURABLA Metal Pump Valve Service will increase general pumping efficiency, and decrease maintenance costs. This can be supplied as an extra. (See page 7 for complete description.)

CAPACITIES OF DARLING DUPLEX HORIZONTAL BOILER FEED AND GENERAL SERVICE PUMPS IN U.S.G.P.M.

Size	U.S. Gallons per Stroke each Cylinder		At Single Strokes Each Side Per Minute													Size Pipe Connections				Floor Space			Weight
			Boiler Feeding and Fuel Oil								General Service				Emergency	Steam	Exhaust	Suction	Discharge	Length	Width	Height	
			20	25	30	35	40	50	60	70	80	90	100	110	120								
3 x2 x3	.041	Boiler H.P. U.S.G. P.M.	27 1.64	34 2	41 2.46	48 2.87	54 3.28	68 4.1	81 4.9	95 5.7	108 6.5	123 7.4	137 8.2	150 9.02	163 9.8	* ⅜	* ½	*1¼	*1	26	9½	13	125
4½x2¾x4	.103	Boiler H.P. U.S.G. P.M.	68 4.1	85 5.1	102 6.1	119 7.2	136 8.2	170 10.3	204 12.3	238 14.4	273 16.5	308 18.5	342 20.6	376 22.6	410 24.7	* ½	* ¾	*2	*1½	36	12½	17	330
5¼x3½x5	.208	Boiler H.P. U.S.G. P.M.	138 8.3	172 10.4	207 12.5	240 14.5	276 16.6	345 20.8	414 24.9	483 29.1	552 33.2	621 37.4	690 41.6	760 45.7	838 5.0	*1	*1¼	*2½	*1½	43	16	17	550
6 x4 x6	.326	Boiler H.P. U.S.G. P.M.	216 13	270 16.3	324 19.5	378 22.8	432 26	540 32.6	648 39.1	756 45.6	865 52.1	974 58.6	1082 65	1190 71.7	1298 78.2	*1	*1½	*3	*2	46	16	22	700
7½x4½x8	.551	Boiler H.P. U.S.G. P.M.	366 22	458 27.5	550 33	643 38.6	743 44	918 55.1	1102 66.1	1285 77.1	1470 88.2	1653 99.2	1837 110.2	2020 121.2	2203 132.2	*1½	*2	†4	†3	63	23	29	1500
7½x4½x10	.689	Boiler H.P. U.S.G. P.M.	457 27.5	571 34.4	685 41.3	800 48.2	914 55.1	1142 68.9	1371 82.6	1600 96.4	1829 110	2059 124	2287 138	2516 151	2744 165	*1½	*2	†4	†3	60	21	29	1650
7½x5 x10	.850	Boiler H.P. U.S.G. P.M.	564 34	705 42.5	846 51	987 59.5	1128 68	1410 85	1692 102	1974 119	2257 136	2539 153	2822 170	3104 187	3386 204	*1½	*2	†4	†3	62	21	29	1675
10 x6 x10	1.224	Boiler H.P. U.S.G. P.M.	827 48.9	1033 61	1240 73	1447 85	1654 98	2067 122	2481 147	2894 171	3250 196	3657 220	4063 245	4470 269	4876 294	*2	*2½	†5	†4	66	26	32	1950
12 x7 x12	2.	Bciler H.P. U.S.G. P.M.	1328 80	1660 100	1992 120	2324 140	2656 160	3320 200	3984 240	4648 280	5312 320	5977 360	6640 400	7304 440	7968 480	*2½	*3	†6	†5	79	32	35	2250

30 pounds or 3.6 U.S. gallons of water per horsepower per hour from 100° F. to 70 pounds steam pressure per square inch.

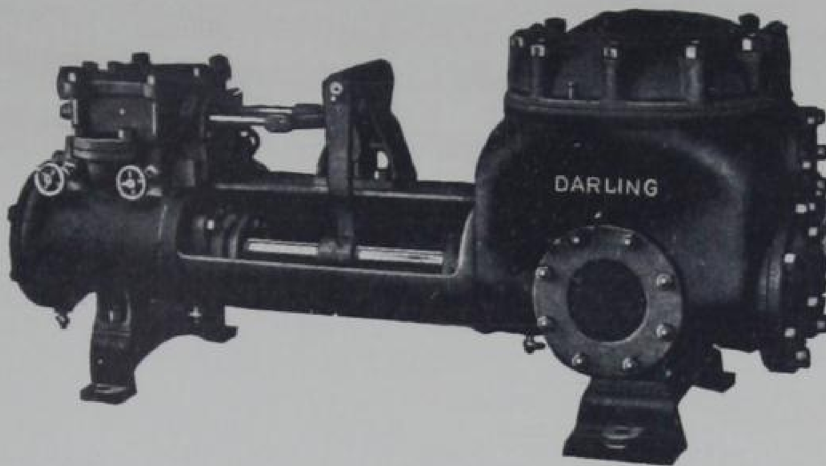
*Screwed Connection †Flanged Connection

Darling Horizontal Duplex Pumps

TANK OR LOW SERVICE

150 Pounds Maximum Steam Pressure

★



75 Pounds Maximum Water Pressure

★

TANK or low service work, where ordinary steam pressures are used, does not require cylinders with as high a ratio as the boiler feed type of pump, therefore we recommend the use of pumps where steam and water cylinders are nearer the same diameter.

Pumps built in this way for use on this type of service are more economical and effective. They combine large pumping capacities with small expenditure of steam. They cover a large range of service such as refineries, distilleries, irrigation work and so forth.

The pump illustrated above shows our standard duplex piston packed valve plate type with side suctions. Size 5¼ x 4¾ x 5″ and smaller are constructed with steam cylinder, yoke and water cylinder cast in one. The pumps are heavily constructed. All parts are interchangeable.

We furnish regularly, iron water pistons and followers, properly packed with square fibrous packing, bronze cylinder linings. The piston rods are of bronze unless otherwise ordered. The water end is fitted with bronze valve seats, valve bolts and springs, with either hard rubber, soft rubber or bronze valves, as the service may require. Steel rods and all iron fitted water ends can be supplied when required.

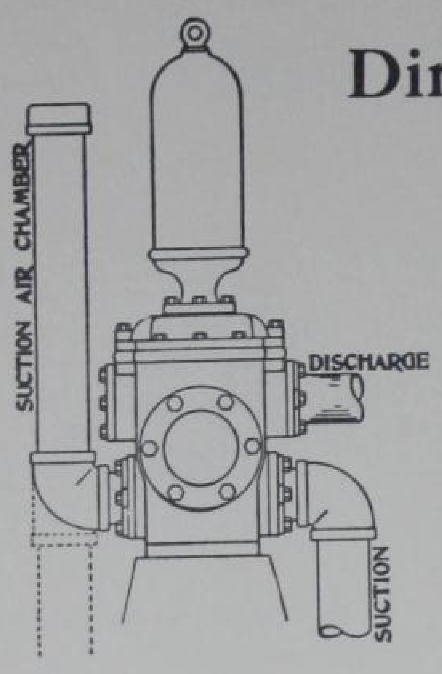
Special types of valves such as Durabla or ball type can be supplied for pumping heavy liquids. See page 7 for complete description.

CAPACITIES OF DARLING HORIZONTAL DUPLEX TANK PUMPS IN U.S.G.P.M.

Size	U.S. Gals. per Stroke Each Cylinder	Single Strokes Each Side Per Minute												Connections				Floor Space			Weight
		Continuous Service							Intermittent Service			Emergency									
		40	50	60	70	80	90	100	110	120	130	140	160	Steam	Exhaust	Suction	Discharge	Length	Width	Height	
3 x 2¾ x 3	.073	5.88	7.35	8.82	10.3	11.7	13.2	14.7	16.2	17.5	19.1	20.4	23.4	½*	½*	2½*	1*	28	10½	16	150
4½ x 3¾ x 4	.191	15	19	23	27	30	34	38	42	46	50	54	61	½*	¾*	2½*	1½*	38	13	19	400
5¼ x 4¾ x 5	.384	30	38	46	53	61	69	76	84	92	100	107	123	¾*	1*	3*	2*	44	16	20	650
6 x 5¾ x 6	.674	53	67	81	94	108	121	135	148	162	175	189	216	1*	1¼*	4†	3†	49	19	22	850
6 x 6 x 6	.732	58	73	87	102	117	131	146	161	175	190	204	234	1*	1¼*	4†	3†	49	19	24	850
7½ x 7½ x 6	1.15	92	115	138	161	184	207	230	253	276	299	322	368	1½*	2*	6†	5†	55	27	30	1550
7½ x 6 x 10	1.22	97	122	146	170	195	219	244	268	293	317	341	390	1½*	2*	5†	4†	62	21	31	1300
7½ x 7 x 10	1.66	132	166	199	232	265	299	332	365	398	431	465	531	1½*	2*	6†	5†	65	23	33	1650
7½ x 8½ x 10	2.45	196	245	294	343	392	441	490	539	588	637	686	784	1½*	2*	6†	5†	65	28	35	1990
10 x 10 x 10	3.39	271	339	407	474	542	610	678	746	813	881	949	1085	1½*	2*	8†	6†	73	30	38	2900

*Screwed Connection. †Flanged Connection

Directions for Setting and Operating Pumps



Instruction Card for setting Steam Valves is supplied with each Pump

WE recommend placing the pump on a cement foundation, in preference to a wooden floor, as the latter is likely to rot in time and bring an undue strain on the pipes, and thus cause leaky joints.

Never use pipes of less diameter than given in the tables. Where long pipes are used, it is necessary to use larger pipes, to allow for the increased friction. Especially must this be observed in suction pipes. A foot valve and strainer should be attached to suction pipe. All pipes should be as short and straight as possible.

Use few elbows, T's, and valves, substituting full round bends for elbows, and Y's for T's, as sharp bends greatly increase the friction. Care must be taken to guard against leaks in the suction pipe, as a very small leak will supply the pump with air to its full capacity, so that little or no water will be obtained according to size of leak.

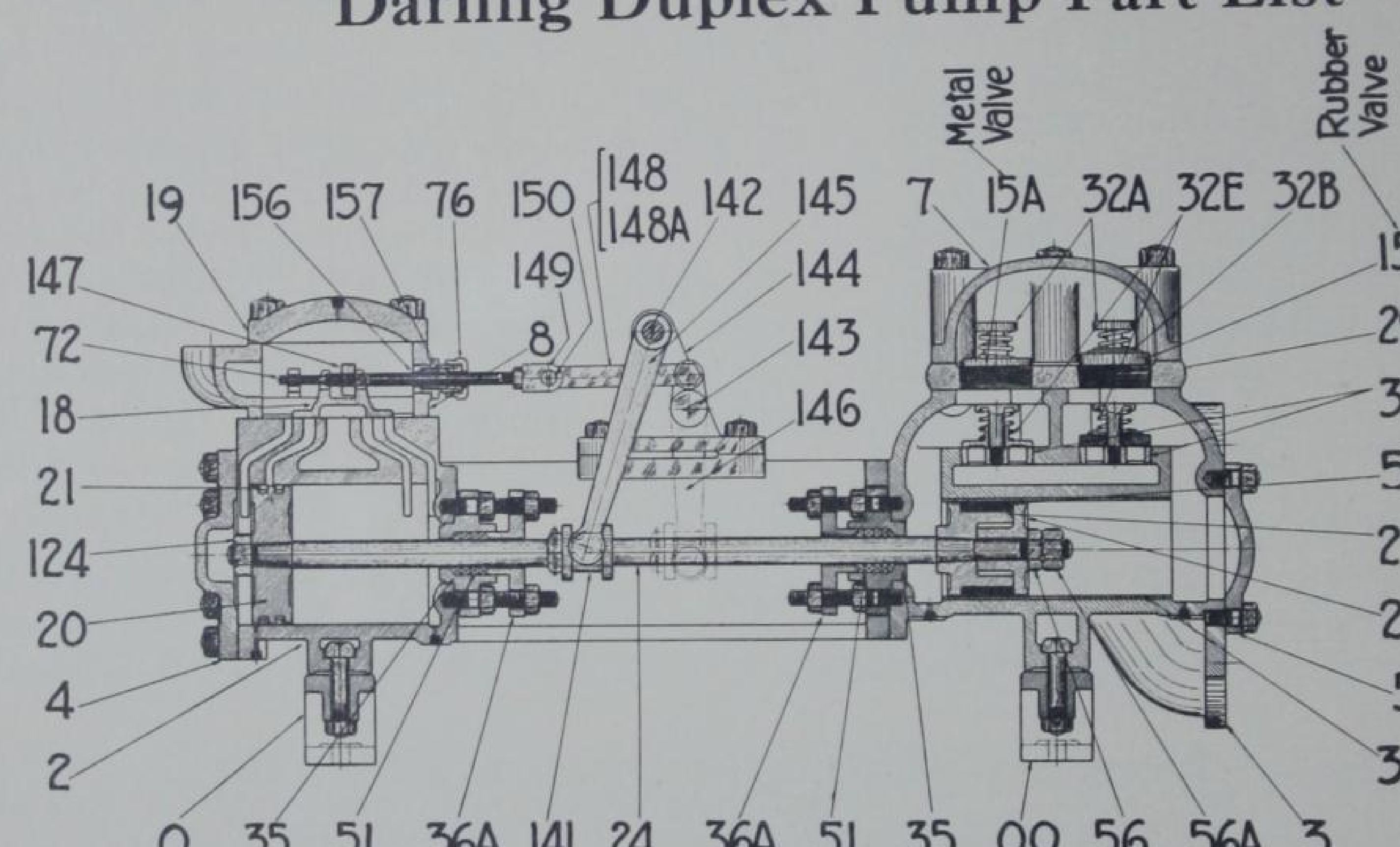
We recommend always using a suction air chamber as shown in the illustration. If the water cylinder has suction openings on both sides, we prefer placing the suction air chamber opposite the suction pipe; but if the cylinder has suction opening on one side only, the suction pipe may be placed on same side of the cylinder as suction air chamber, as shown in the illustration in dotted lines. This suction air chamber is made from a piece of pipe same size as the suction pipe, and from four to six feet long, capped on the top and fastened to the water cylinder by a short nipple, and an elbow or T, as may be required. On a long suction pipe, in high lifts, or when the pump is running at high speed, this air chamber is a positive necessity. Its utility consists in causing a steady and uniform flow of water through the suction pipe, and thus preventing "pounding or water hammering" which, without an air chamber, is always incident in long suctions.

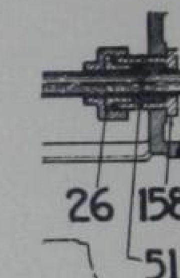
In running pipe to or from the pump, avoid the possibilities of air pockets being formed in the pipe.

Water at high temperature cannot be raised any considerable distance by suction, as the vapor discharged from the water so heated follows the receding piston of the pump, and resists the entrance of the water; consequently, to pump hot water, always place the supply above the pump, so that it will be supplied from a head.

Use good cylinder oil only, and oil steam end just before stopping the pump.
Keep stuffing boxes full of good packing, well oiled, and just tight enough to prevent leakage without excessive friction.
If the pump runs badly, make sure that the water valves and water pipes are all right before examining the steam end.
In cold weather, open all cocks and drain plugs to prevent freezing, when the pump is not in use.
Always see that the pump has a full and steady supply of water, or other fluid.

Darling Duplex Pump Part List





***Boiler Feed Pumps** 6" x 4" x 6" and larger*

***Tank Pumps** 6" x 5¾" x 6" and larger*

Note Screwed Glands used on Pumps up to 5" Stroke take Part Numbers 26, 27, 158, 51

Pumps 5¼" x 3½" x 5" and smaller are made with steam and water cylinders cast on yoke

0 —Steam Cylinder Foot
00 —Water Cylinder Foot
2 —Steam Cylinder
3 —Water Cylinder
4 —Steam Cylinder Head
5 —Water Cylinder Head
7 —Valve Chamber Cover
8 —Steam Chest
15 —Rubber Water Valves
15A—Metal Water Valves
18 —Steam Valve
19 —Steam Chest Cover
20 —Steam Piston
21 —Steam Piston Rings
22 —Water Piston
23 —Water Piston Follower
24 —Piston Rod
26 —Piston Rod Gland Nut
27 —Piston Rod Gland Follower
29 —Water Valve Plate
30 —Water Cylinder Lining
32 —Water Valve Seats
32A—Water Valve Bolts
32B—Water Valve Washers
32E—Water Valve Springs
35 —Piston Rod Stuffing Box
36A—Piston Rod Stuffing Box Gland
50 —Water Piston Packing
51 —Piston Rod Packing
56 —Water Piston Nut
56A—Water Piston Jam Nut
72 —Valve Rod
76 —Valve Rod Stuffing Box Gland Nut
124 —Steam Piston Rod Nut
141 —Piston Rod Spool
142 —Upper Rock Shaft
143 —Lower Rock Shaft
144 —Cross Stand
145 —Long Lever
146 —Short Lever
147 —Valve Rod Nut
148 —Long Valve Rod Link
148A—Short Valve Rod Link
149 —Valve Rod Head
150 —Valve Rod Head Pin
156 —Valve Rod Stuffing Box
157 —Valve Rod Stuffing Box Packing
158 —Piston Rod Stuffing Box, Screwed Type

In ordering repairs, give shop number and size of pump

Darling Steam-driven Condensation Pumps

DARLING Steam-Driven Condensation Return Units are illustrated, equipped with either simplex or duplex pattern pumps. While the simplex pump is much more economical in steam consumption, the duplex is often preferred by operating engineers; on this account we are prepared to supply either pattern.

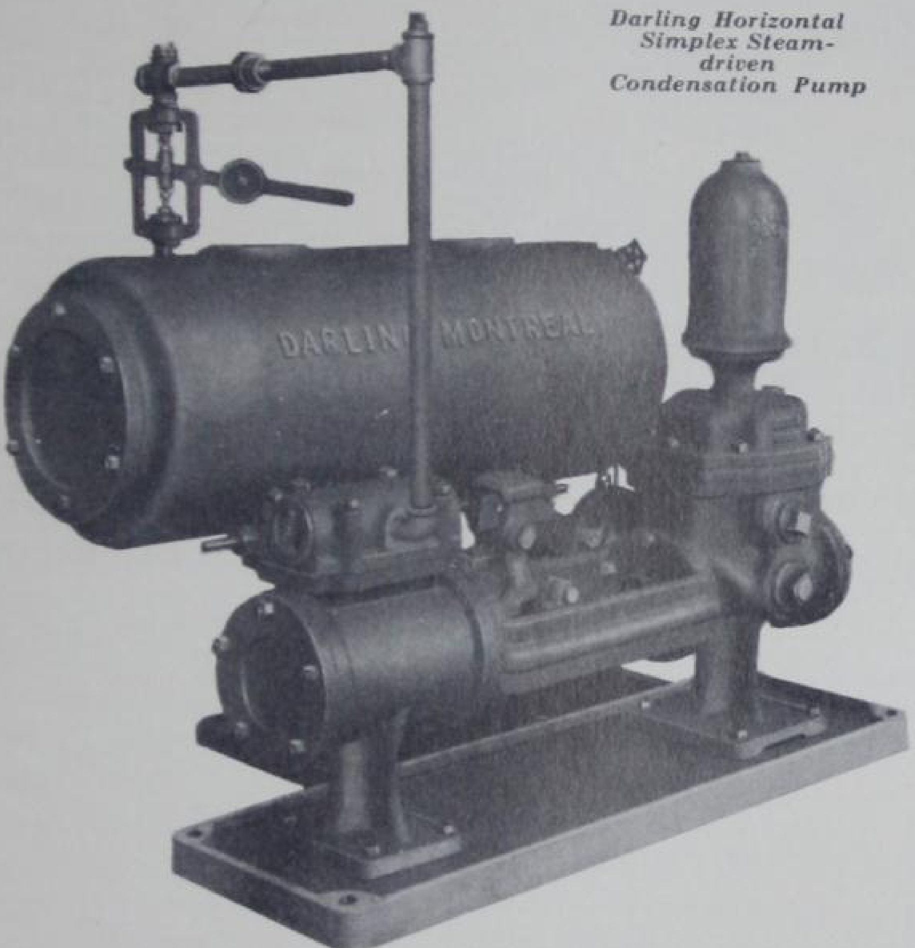
Both styles are made in single or duplicate units, the advantage of the duplicate unit being that it provides a stand-by and enables repairs to be made to one pump without affecting the operation of the plant.

The Receiver and Pump are arranged compactly upon one drip pan base plate, the receiver being set to allow condensation to flow from the lowest line of pipes in the heating system.

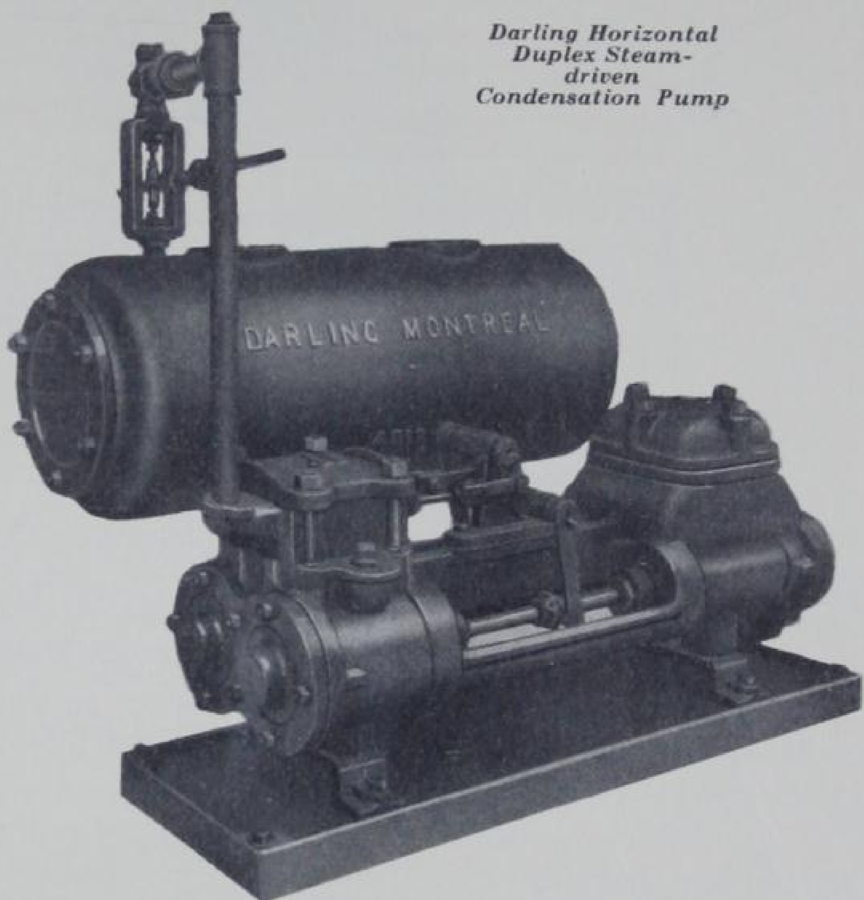
Steam control float valve is of improved design, very sensitive and reliable. Valve spindle glands are accessible and easily packed. Copper float is seamless, ensuring long life.

Where steam is used for heating purposes, as in hotels, apartment houses, factories and large buildings, it has been found advantageous to feed the water of condensation direct to the boilers at the highest possible temperature.

Lubricators are not included as regular equipment, but either forced feed or sight feed styles can be supplied at extra cost. For illustrations of makes we recommend and carry in stock, see page 7.



Darling Horizontal Simplex Steam-driven Condensation Pump



Darling Horizontal Duplex Steam-driven Condensation Pump

SIMPLEX CONDENSATION RETURN PUMPS AND RECEIVERS

Code	No.	Size Pump	Size Receiver	No. and Size Rec. Inlet	Length	Width	Height	Cap. Sq. Ft. of Radiation	Weight in Lbs.
Kleo	2B	4 x2½x 5	Oval	1—2″	30	24	26	6200	575
Keno	4B	5 x3 x 6	15x26	2—2½″	46	30	32	10000	900
Kent	5B	5½x3½x 7	15x36	2—2½″	46	30	32	14000	1250
Kinde	7B	6⅛x4 x 8	15x36	2—2½″	47	33	36	20000	1360
Kunap	8B	7 x4½x10	15x36	2—2½″	58	36	36	32000	2200
Kloman	9B	8½x5 x10	24x38	2—4″	61	41	36	40000	2350
King	10B	10 x6 x12	24x38	2—4″	68	43	39	60000	3000
Keystone	11B	12 x8 x12	24x38	2—4″	71	44	39	100000	3900

DUPLEX CONDENSATION RETURN PUMPS AND RECEIVERS

Code	No.	Size Pump	Size Receiver	No. and Size Rec. Inlet	Length	Width	Height	Cap. Sq. Ft. of Radiation	Weight in Lbs.
Duplet	1D	3 x2 x 3	Oval	1—2″	26	24	26	4000	500
Dupary	2D	4½x2¾x 4	15x26	2—2½″	36	26	32	10000	900
Duption	5D	5¼x3½x 5	15x36	2—2½″	46	32	36	18000	1250
Dupive	7D	6 x4 x 6	15x36	2—2½″	46	32	36	26000	1430
Dupness	8D	7 x4½x 8	24x38	2—4″	70	36	40	40000	4000
Dupate	9D	7½x5 x10	24x38	2—4″	78	54	40	60000	4200

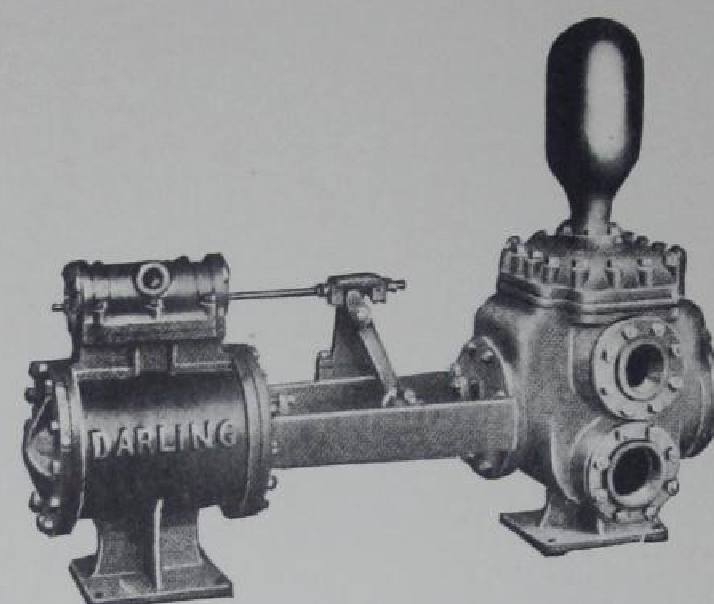
Standard Receivers are cast iron. Steel receivers supplied on special order.

Darling Horizontal Simplex Pumps

BOILER FEED OR GENERAL SERVICE

Maximum Steam Pressure 150 Pounds

★



Maximum Water Pressure 150 Pounds

★

THIS illustration represents our Darling Horizontal Simplex Pump, economical in steam consumption for general service, such as boiler feeding and other high duty work. This pump is double-acting and has piston arranged for square fibrous packing, and is suitable for handling hot or cold water; it is fitted with bronze piston rod, bronze water lining, bronze valve seats and bolts, and rubber valves, unless otherwise ordered; but bronze valves may be used if so desired. All water valve seats are screwed in place; rubber or bronze valves are interchangeable on same seats, bolts and springs. Durabla metal pump valves supplied as an extra. (For description see page 7.)

CAPACITY OF DARLING SINGLEX HORIZONTAL BOILER FEED AND GENERAL SERVICE PUMPS IN U.S.G.P.M.

Size	U.S. Gals per Stroke		Single Strokes per Minute														Size Pipe Connections				Floor Space			Weight
			Boiler Feed								General Service				Emergency		Steam	Exhaust	Suction	Discharge	Length	Width	Height	
			20	25	30	35	40	45	50	60	70	80	90	100	110	120								
4 x2½x 5	.106	Boiler H.P.	35	44	53	62	71	79	88	105	123	141	158	176	193	211	* ½	* ¾	*1½	*1¼	30	7	22	190
		U.S.G.P.M.	2.12	2.65	3.18	3.71	4.24	4.77	5.3	6.36	7.42	8.48	9.54	10.6	11.66	12.72								
5 x3 x 6	.183	Boiler H.P.	61	76	91	112	122	137	152	182	213	243	273	304	334	364	* ½	* ¾	*2	*1½	35	8	25	280
		U.S.G.P.M.	3.66	4.58	5.49	6.4	7.32	8.23	9.15	10.98	12.8	14.6	16.4	18.3	20.1	21.9								
6⅛x4 x 8	.434	Boiler H.P.	144	180	216	252	288	324	360	432	504	576	648	720	792	865	* ¾	*1	*2½	*2	47	10	30	475
		U.S.G.P.M.	8.7	10.8	13	15.2	17.4	19.5	21.7	26.2	30.4	34.8	39	43.4	47.7	52								
7 x4½x10	.69	Boiler H.P.	229	286	344	401	458	515	573	687	802	916	1030	1145	1260	1375	* ¾	*1	*3	*2½	54	12	37	700
		U.S.G.P.M.	13.8	17.25	20.7	24.1	27.6	31	34.5	41.4	48.2	55.2	62.1	69	76	83								
8½x5 x10	.85	Boiler H.P.	282	353	474	494	564	635	705	847	988	1129	1269	1411	1552	1693	*1	*1½	*3½	*3	61	15	43	850
		U.S.G.P.M.	17	21.25	25.5	29.7	34	38	42.5	51	59.4	68	76.5	85	93	102								
8½x5½x10	1.02	Boiler H.P.	338	423	508	593	677	762	846	1015	1185	1354	1523	1693	1862	2031	*1	*1½	*3½	*3	61	15	43	860
		U.S.G.P.M.	20.4	25.5	30.6	35.7	40.8	46	51	61.2	71.4	81.6	92	102	112	122.4								
10 x6 x12	1.72	Boiler H.P.	571	714	856	999	1142	1286	1427	1713	1998	2284	2570	2855	3140	3426	*1½	*2	†4	†3	68	18	46	1600
		U.S.G.P.M.	34	43	52	60	68	77	86	104	120	136	155	172	189	206								
12 x7 x12	2.00	Boiler H.P.	664	830	990	1162	1328	1494	1660	1992	2324	2656	2988	3320	3652	3984	*1½	*2	†5	†4	69	19	52	2300
		U.S.G.P.M.	40	50	60	70	80	90	100	120	140	160	180	200	220	240								
12 x8 x12	2.61	Boiler H.P.	866	1083	1300	1516	1733	1949	2166	2599	3033	3466	3899	4333	4765	5199	*1½	*2	†6	†5	71	23	60	2500
		U.S.G.P.M.	52	65	78	91	104	117	130	156	182	208	235	261	287	312								
14 x8 x16	3.48	Boiler H.P.	1155	1444	1733	2022	2311	2600	2888	3466	4043	4621	5199	5776	6354	6932	*2	*2½	†6	†5	95	24	61	2900
		U.S.G.P.M.	70	87	104	122	140	156	174	208	244	280	313	348	383	416								
16 x10 x16	5.44	Boiler H.P.	1806	2257	2709	3160	3612	4063	4515	5418	6321	7224	8127	9030	9933	10836	*2	*2½	†8	†6	97	25	65	3900
		U.S.G.P.M.	109	136	163	190	218	245	272	326	380	436	490	544	598	652								

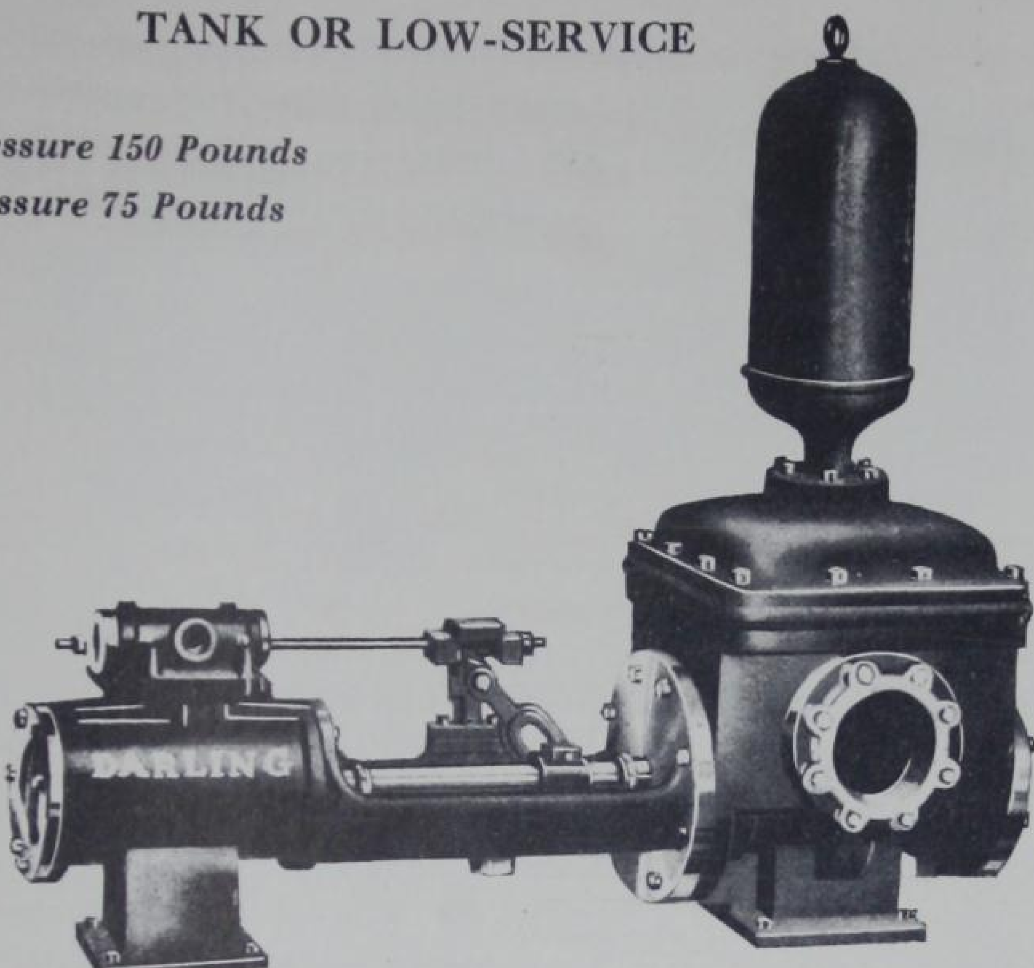
30 pounds or 3.6 U.S. gallons of water per horse power per hour from 100° F. to 70 pounds steam pressure per square inch.

*Screwed Connection †Flanged Connection

Darling Horizontal Simplex Pumps

TANK OR LOW-SERVICE

Maximum Steam Pressure 150 Pounds
Maximum Water Pressure 75 Pounds



TANK or low service work, where ordinary steam pressure is used, does not require cylinders with as high a ratio as the boiler feed type of pump, therefore we recommend the use of pumps where steam and water cylinders are nearer the same diameter.

Pumps built in this way and used on this service are more economical and effective. They combine large pumping capacities with small expenditure of steam. They cover a large range of service such as refineries, distilleries, irrigation work and so forth.

We furnish regularly, iron water pistons and followers, properly packed with square fibrous packing, bronze cylinder linings. The piston rods are of bronze unless otherwise ordered. The water end is fitted with bronze valve seats, valve bolts and springs, with either hard rubber, soft rubber or brass valves, as the service may require. Steel rods and all iron fitted water ends can be supplied when required.

Special types of valves such as Durabla or ball type can be supplied for pumping heavy liquids. See page 7 for complete description.

CAPACITIES OF DARLING HORIZONTAL SIMPLEX TANK OR LOW SERVICE PUMPS IN U.S.G.P.M.

Size	U.S. Gals. per Stroke	Single Strokes Per Minute													Connections				Floor Space		Weight
		Continuous Service									Intermittent Service										
		20	25	30	35	40	50	60	70	80	90	100	110	120	Steam	Exhaust	Suction	Discharge	Length	Width	
4 x 3½x 5	.208	4.1	5.2	6.2	7.3	8.2	10.4	12.4	14.6	16.4	18.7	20.8	23	25	*½	*¾	*2½″	*2	33	10	280
5 x 4½x 6	.412	8.2	10.2	12.4	14.4	16.4	20.4	24.8	28.8	32.8	37	41.6	46.4	49.6	*½	*¾	*3	*2½	36	10	410
5½x 6 x 6	.733	14.7	18.3	22	25.7	29.4	36.6	44	51.4	58.8	66	73.2	80.7	88	*¾	*1	*3	*2½	40	12	600
6⅛x 6 x10	1.223	24.5	30.6	36.7	42.8	49	61.2	73.4	85.6	98	110	122.4	134	147	*¾	*1	†4	†3	51	15	670
7 x 7 x10	1.665	33	42	50	58	66	84	100	116	133	150	167	183	200	*¾	*1	†4	†3	56	15	750
8 x 8 x12	2.610	52	65	78	91	104	130	156	182	208	235	261	287	312	*1	*1½	†5	†4	67	18	1550
10 x10 x12	4.080	81.6	102	122	143	163	204	244	286	326	367	408	449	488	*1½	*2	†8	†6	72	21	2000
12 x12 x12	5.870	117	147	176	206	234	294	352	412	468	528	587	646	704	*1½	*2	†8	†6	78	24	2600
14 x14 x16	10.659	214	267	320	374	427	534	640	746	854	960	1066	1176	1280	*2	*2½	†10	†8	88	26	4000

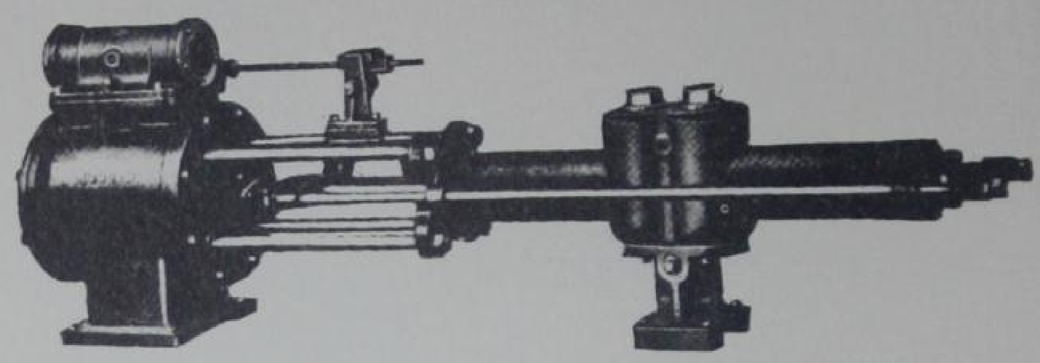
*Screwed Connection †Flanged Connection

Darling Simplex Hydraulic-Pressure Pumps

Maximum Steam Pressure 150 Pounds

Maximum Water Pressure 2,000 Pounds Cast Iron Cylinders

Maximum Water Pressure 5,000 Pounds Forged Steel Cylinders



DIRECT-ACTING Hydraulic-Pressure Pumps are used in connection with oil and cotton presses, testing machines, hydraulic rivetting, punching and flanging machinery, and all high-pressure work.

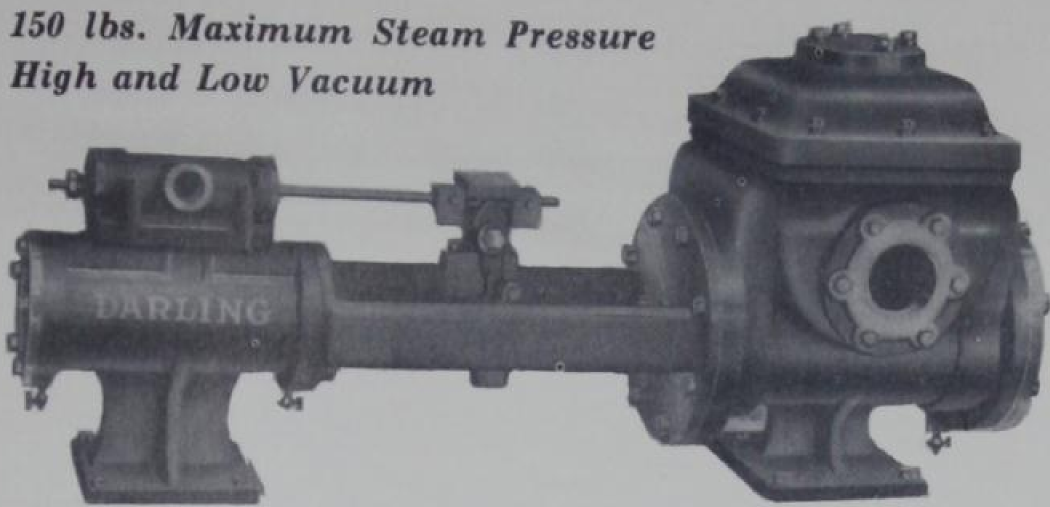
These hydraulic pumps are built with cast iron water cylinders, for which the pressure is stated below. For higher pressures, up to 5,000 pounds per square inch, the entire water cylinder is made from a solid open-hearth-steel forging. The valves are of steel, seating on steel seats which are part of the cylinder itself. Monel metal valves and seats giving better wearing qualities can be supplied at extra cost. Separate bronze plugs are provided by removal of which each valve may be reached independently.

CAPACITIES OF DARLING SIMPLEX HYDRAULIC-PRESSURE PUMPS IN U.S.G.P.M.

Code	Size	U.S. Gals. per Stroke	Steam	Ex-haust	Suc-tion	Dis-charge	Bal. Pressure at 85 Pounds of Steam	Max. Pressure for Cast-Iron Cylinders	Length	Width	Height	Weight
Salvo	5½x1 x 7	.0238	¾	1	1	¾	2300	2000	82	11	19	520
Solo	5½x1⅛x 7	.0301	¾	1	1	¾	1800	2000	82	11	19	520
Spero	5½x1¼x 7	.0371	¾	1	1	¾	1480	2000	82	11	19	520
Saginaw	8½x1¼x10	.053	1	1½	1¼	1	3530	2000	102	13	21	850
Sagola	8½x1⅜x10	.064	1	1½	1¼	1	2920	2000	102	13	21	850
Sailor	8½x1½x10	.076	1	1½	1¼	1	2450	2000	102	13	21	850
Salem	8½x1⅝x10	.089	1	1½	1¼	1	2090	2000	102	13	21	850
Sherman	8 x1¼x12	.0636	1	1½	1¼	1	3130	2000	115	12	27	900
Sheridan	8 x1½x12	.0912	1	1½	1¼	1	2170	2000	115	12	27	900
Shepherd	8 x1¾x12	.1248	1	1½	1¼	1	1600	2000	115	12	27	900
Shelby	8 x2 x12	.1632	1	1½	1½	1¼	1200	2000	115	12	27	1200
Sharon	8 x2½x12	.2544	1	1½	1½	1¼	800	1000	115	12	27	1600
Sanford	10 x1½x12	.0912	1½	2	1¼	1	3400	2000	116	14	30	1100
Sanilac	10 x1¾x12	.1248	1½	2	1¼	1	2500	2000	116	14	30	1300
Scotts	10 x2 x12	.1632	1½	2	1½	1¼	1910	2000	116	14	30	1300
Sithton	10 x2½x12	.2544	1½	2	1½	1¼	1200	1000	116	14	30	1700
Sawyer	12 x1½x12	.0912	1½	2	1¼	1	4890	2000	120	16	31	1300
Scio	12 x1¾x12	.1248	1½	2	1¼	1	3590	2000	120	16	31	1650
Scipio	12 x2 x12	.1632	1½	2	1½	1¼	2750	2000	120	16	31	1650
Sager	12 x2½x12	.2544	1½	2	1½	1¼	1760	1000	120	16	31	2100
Selkirk	14 x1¾x12	.1248	2	2½	1¼	1	4900	2000	120	18	32	1900
Seneca	14 x2 x12	.1632	2	2½	1½	1¼	3750	2000	121	18	32	1900

Darling Vacuum Pumps

150 lbs. Maximum Steam Pressure
High and Low Vacuum



Low Duty

THE Darling Low Duty Vacuum Pump shown in the illustration is especially designed for continuous and heavy service. They have generous valve area, and are heavily built to withstand rough usage. They are especially recommended for use with condensers, for handling condensation from paper machines, dry kilns, vacuum heating systems, and for any other purpose where an ordinary degree of vacuum is required. The capacities given in sq. ft. equivalent direct radiation are very conservative and may be increased for tight systems.

These pumps are bronze fitted, having rolled bronze piston rods, bronze cylinder liners, bronze valve seats, bolts and springs, and are furnished with soft rubber valves unless otherwise specified.

High Duty

THE Darling High Duty Vacuum Pump is for continuous and heavy service. They have large valve area, which permits their use with jet condensers operating on the wet system. They are equipped with water-seal gland for piston rod, so that they may be used at 26-inch vacuum, and the operator may be assured that the stuffing box will hold tight under these conditions with a minimum amount of attention.

These pumps are bronze fitted, having rolled bronze piston rods, bronze cylinder liners, bronze valve seats, bolts and springs, and are furnished with soft rubber valves unless otherwise specified.

CAPACITIES OF DARLING VACUUM PUMPS IN U.S.G.P.M.

★Code: High Duty	Size	U.S. Gals. Per Stroke	Cu. Ft. Per Stroke	Sq. Ft. Rad.	Approx. Number of Strokes	Steam	Exhaust	Suction	Discharge	Length	Width	Height	Weight
Upshaw	5 x 6 x 6	.7338	.09	6,000	36	*½	*¾	*3	*2½	37	11	19	400
Ursa	5 x 7 x 10	1.665	.222	15,000	28	*¾	*1	†4	†3	54	12	22	690
Usal	6⅛ x 8 x 10	2.175	.29	20,000	28	*¾	*1	†4	†3	58	15	24	850
Undine	8 x 10 x 12	4.08	.545	30,000	22	*1	*1½	†6	†5	65	18	27	1320
Utopia	10 x 12 x 12	5.87	.785	40,000	22	*1½	*2	†8	†6	71	20	30	2000
Umbria	10 x 12 x 16	7.83	1.05	50,000	22	*1½	*2½	†8	†6	79	20	30	2200
Upron	10 x 14 x 16	10.659	1.42	80,000	22	*1½	*2½	†10	†8	79	22	35	2400
Upset	12 x 16 x 20	17.4	2.32	100,000	21	*1½	*2½	†10	†8	112	25	43	4000
Upart	12 x 18 x 20	22.02	2.94	130,000	20	*1½	*2½	†12	†10	118	28	48	4200

Other Steam and Air Cylinder Ratios available.
Cast iron yoke type size 8 x 10 x 12 and smaller.
Tie rod yoke type size 10 x 10 x 12 and larger.

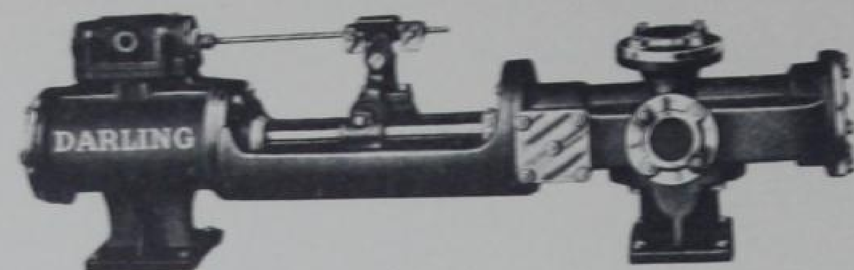
* Screwed Connections
† Flanged Connections

★ Code words are for High Vacuum Pumps. If Low Vacuum Pumps are required, add the letter "Z" to Code word.

Darling Magma Pumps

150 Pounds Maximum Steam Pressure

★



75 Pounds Maximum Liquid Pressure

★

THESE pumps are designed to deal with semi-fluids and are of the double-acting singlex type. A large suction branch is arranged at the centre of the pump to allow the semi-liquids to flow easily to the pump and be drawn into the barrel. The long piston passes across and closes this opening, and expels the fluid through the large discharge valves, one on each end of barrel.

There are no suction valves, and few moving parts.

Special attention has been given to render the valves easily accessible. The cylinder passages are direct and of large area.

The steam cylinder is fitted with our standard Valve Gear, which can be regulated to give a constant stroke.

★ ★ ★

Fisher Pump Governors

ANGLE and GLOBE PATTERN, SCREWED or FLANGED OPENINGS—MADE IN SIZES ½ TO 6

SINCE 1881 Fisher Regulating Devices for steam pumps have been regarded as standard for boiler feed pumps, refinery pumps and steam pumps for all industrial applications.

The pump governors illustrated on this page can be furnished in either angle or globe patterns. Standard valves in sizes ½″ to 3″ screwed for pressures up to 250 pounds pressure per square inch or ¾″ to 6″ flanged for 125 or 250 pounds pressure per square inch.

Valves for higher pressures and superheat available on application.

Constant Pressure Governor . . . Type 1

Purpose:

Constant Pressure Pump Governor No. 1

This valve is built for controlling and maintaining a constant discharge pressure on steam-driven pumps of either the reciprocating or turbine driven types.

Approved and listed as standard by the Underwriters' Laboratories for fire pump service.

Fitted with test valves and top work as illustrated.

Discharge pressure setting adjusted by handwheel.

Recommended discharge pressure ranges Pounds per square inch:

40 lbs. to 100 lbs.	160 lbs. to 400 lbs.
85 lbs. to 210 lbs.	200 lbs. to 500 lbs.
120 lbs. to 300 lbs.	

Excess or Differential Pump Governor Type 444

Purpose:

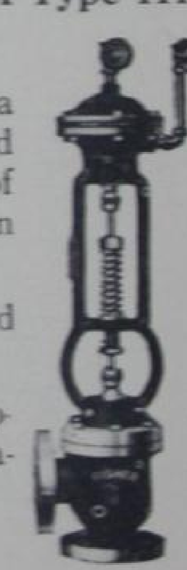
This valve is built for maintaining a fixed differential or over-pressure on feed water lines on boiler feed water pumps of either the reciprocating or turbine driven types.

This valve built with a spring-controlled diaphragm.

Long calibrated steel spring, which opposes the differential pressure on the diaphragm, gives easy throttling control.

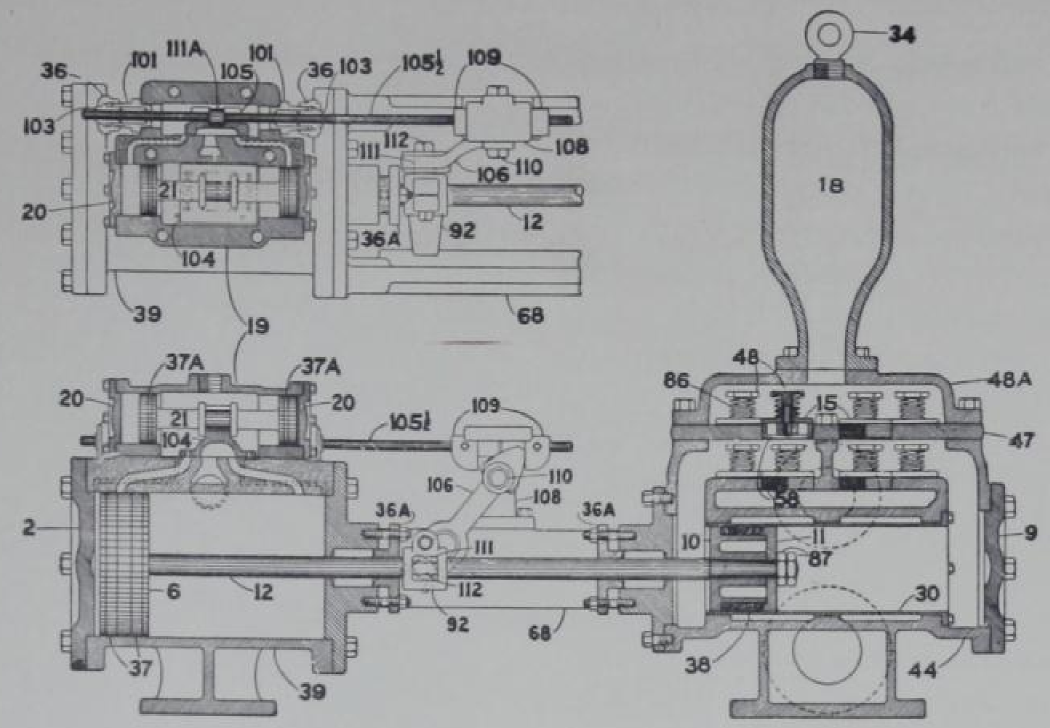
Recommended differential pressure ranges. Pounds per square inch:

10 lbs. to 25 lbs.	20 lbs. to 60 lbs.
10 lbs. to 35 lbs.	40 lbs. to 100 lbs.



Excess or Differential Pump Governor No. 444

Darling Simplex Pump Part List

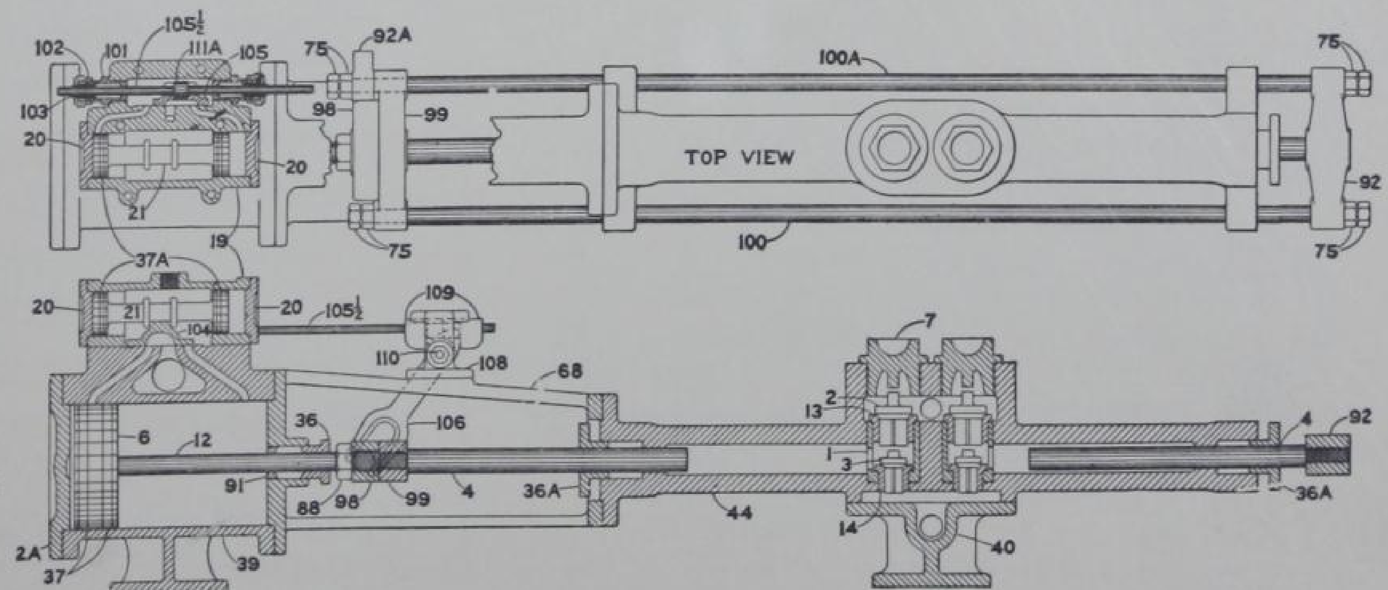


- 2 Outside Steam Cylinder Head
- 3 Inside Steam Cylinder Head for Yoke
- 6 Steam Piston
- 9 Water Cylinder Head
- 10 Water Piston Head
- 11 Water Piston Follower
- 12 Piston Rod
- 15 Water Valves
- 18 Air Chamber
- 19 Steam Valve Chest
- 20 Steam Valve Chest Heads
- 21 Steam Chest Piston
- 30 Water Cylinder Lining
- 34 Air Chamber Plug
- 36 Auxiliary Valve Stem Stuffing Box Nuts
- 36A Piston Rod Glands
- 37 Steam Cylinder Rings
- 37A Steam Chest Rings
- 38 Water Piston Packing
- 39 Steam Cylinder
- 44 Water Cylinder
- 47 Water Valve Plate
- 48 Water Valve Bolts
- 48A Water Cylinder Hood
- 58 Water Valve Seats
- 68 Yoke and Cylinder Head or Tie Rods
- 86 Water Valve Springs
- 87 Water Piston Jam Nuts
- 92 Piston Rod Guide
- 101 Auxiliary Valve Stem Stuffing Boxes
- 103 Auxiliary Valve Stem Stuffing Box Glands
- 104 Main Slide Valve
- 105 Auxiliary Slide Valve
- 105½ Auxiliary Valve Stem
- 106 Actuating Lever
- 108 Standard for Actuating Lever
- 109 Right and Left Cam Blocks
- 110 Actuating Lever Stud
- 111 Piston Rod Stud Collar
- 111A Collar on Valve Stem
- 112 Piston Rod Guide Stud
- 115 Water Cylinder Head for Yoke Rods
- 116 Clamp for Actuating Lever Standard

Cast Iron Yoke Type—size 8½ x 5 x 10 and smaller
Tie-Rod Yoke Type—size 10 x 6 x 12 and larger

Darling Hydraulic Pressure Pump Part List

- 2 (Hydraulic) Discharge Valves
- 2A (Hydraulic) Outside Steam Cylinder Head
- 3 Suction Valves
- 4 Plungers
- 6 Steam Piston
- 7 Discharge Valve Caps
- Leather Washers for D.V. Caps
- 12 Piston
- 13 Discharge Valve Seats
- 14 Suction Valve Seats
- 15 Water Valves
- 18 Air Chamber
- 19 Steam Valve Chest
- 20 Steam Valve Chest Heads
- 21 Steam Chest Piston
- 34 Air Chamber Plug
- 36 Piston Rod Stuffing Box
- 36A Plunger Glands
- 37 Steam Cylinder Rings
- 37A Steam Chest Rings
- 39 Steam Cylinder
- 40 Water Cylinder Base
- 44 Water Cylinder
- 47 Water Valve Plate
- 48 Water Valve Bolts
- 48A Water Cylinder Hood
- 58 Water Valve Seats
- 68 Tie Rods or Yoke
- 75 Side Rod Nuts
- 86 Water Valve Springs
- 88 Piston Rod Nut
- 91 Bottom of Stuffing Box on Steam End of Yoke
- 92 Outside Plunger Crosshead
- 92A Actuating Lever Block
- 98 Piston Rod Crosshead
- 100 (Hydraulic) Short Side Rod
- 100A (Hydraulic) Long Side Rod
- 101 Auxiliary Valve Stem Stuffing Boxes
- 102 Auxiliary Valve Stem Stuffing Box Nuts
- 103 Auxiliary Valve Stem Stuffing Box Glands
- 104 Main Slide Valve
- 105 Auxiliary Slide Valve
- 105½ Auxiliary Valve Stem
- 106 Actuating Lever
- 106½ Actuating Lever Rod
- 108 Standard for Actuating Lever
- 109 Right and Left Cam Blocks
- 110 Actuating Lever Stud
- 111 Guide for Actuating Lever Rod
- 111A Collars on Valve Stem Rod
- 112 Stud Bolt for Actuating Lever Rod Guide
- 116 Clamp for Actuating Lever Standard



When ordering repair parts give size of pump and serial number

Darling Twin Fuel Oil Pumping Units

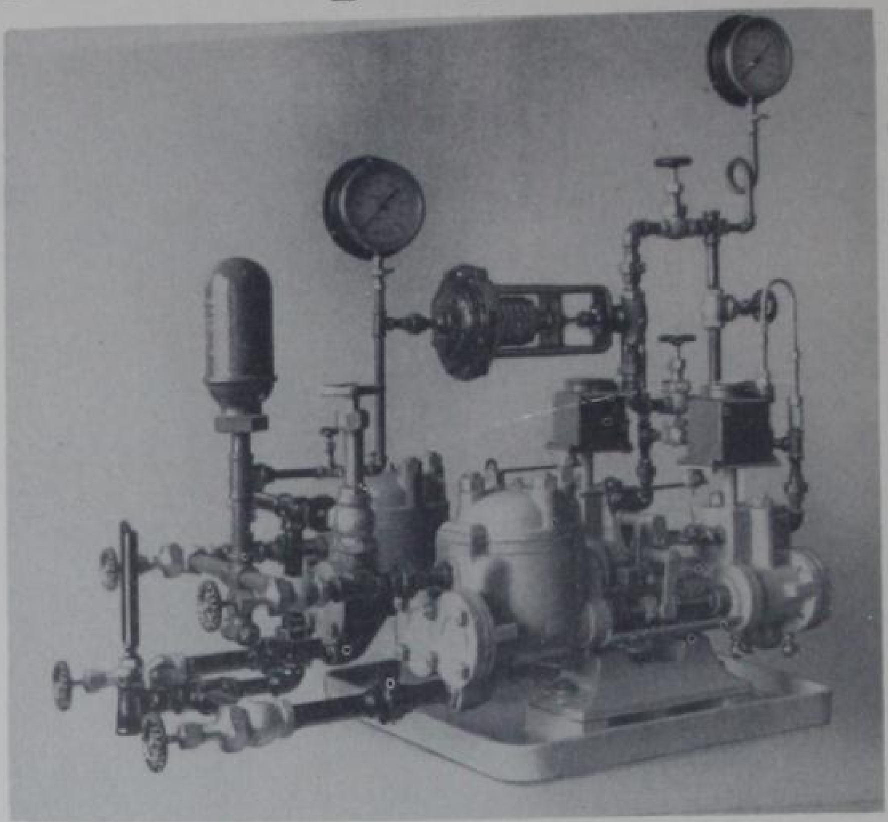
THE illustrations on this page show Darling Twin Oil Pumping Units specially designed for fuel oil service.

The first illustration shows a Twin Pumping Unit using 3″ x 2″ x 3″ duplex steam pumps completely connected up and mounted on a drip pan base. Fittings include oil pressure governor, mechanical lubricators, pressure gauges, air chamber, relief valve, thermometer and the necessary valves, unions and piping as illustrated.

The second illustration shows a Twin Pumping and Heating Unit using 5½″ x 3½″ x 5″ duplex steam pumps mounted in a drip pan over suitable oil heaters. The heaters have steel shells, tube plates and tubes with semi-steel heads easily removable for cleaning tubes; the shells are insulated and covered with planished steel. The fittings include oil pressure governor, mechanical lubricators, pressure gauges, air chamber, relief valves, thermometers and the necessary valves, unions and piping all connected up so that either pump can be used with either heater.

These units can be built to meet a wide variety of specifications as regards capacities, pressures and temperatures for either land or marine service.

Maximum working pressure for the heater shell is 150 lbs. per square inch. The pumps are designed for 200 lbs. working pressure.

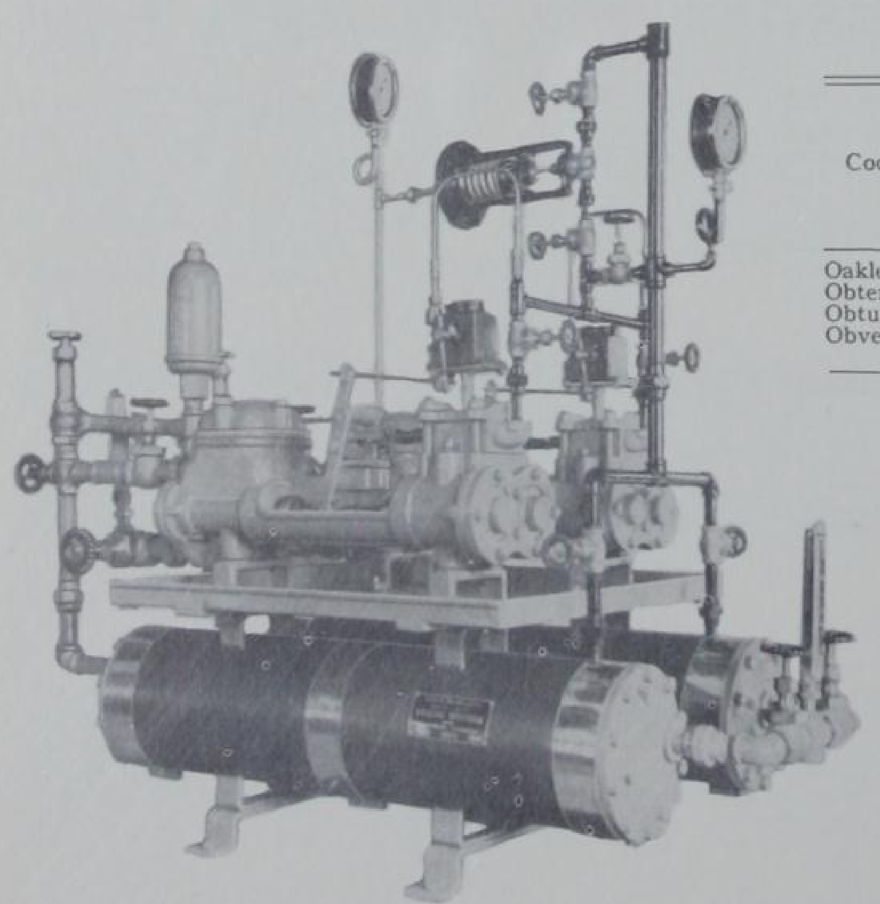


Two Duplex Piston Packed Pumps — *Size, 3″ x 2″ x 3″*

The pumps are equipped with bronze-lined fluid cylinders, steel piston rods, cast-iron steam pistons, oil pistons, fitted with snap rings. If bronze fitted pumps are required, bronze fittings should be specified when placing an order. Durabla metal pump valves can be supplied as an extra. For description see page 7.

CAPACITY TABLE

Code	Size of Pumps	U.S. Gallons per Minute Each Pump	Boiler Horse Power each Pump will Supply	Length Inches	Width Inches	Height Inches	Pipe Size—Inches Steam	Exhaust	Suction	Discharge
Oakley	3 x2 x3	3- 6	300- 600	36	26	55	⅜	½	1¼	1
Obtend	4½x2¾x4	9-18	900-1800	45	30	58	½	¾	2	1½
Obtuse	5¼x3½x5	18-36	1800-3600	54	36	64	1	1¼	2½	1½
Obvert	6 x4 x6	25-50	2500-5000	57	38	66	1	1½	3	2



Two Duplex Piston Packed Pumps, with Duplicate Oil Heaters
Size, 5¼″ x 3½″ x 5″

FRICTION OF WATER IN PIPES

Loss of Head in Feet Due to Friction, per 100 Feet of 15 year old Ordinary Iron Pipe
For smooth new wrought iron pipe, multiply friction values by .71. For old W.I. Pipe multiply by 1.52.

Vel.—Velocity in Feet per Second.
Fric.—Friction Head in Feet.

U.S. Gallons per Minute	½″ Pipe		¾″ Pipe		1″ Pipe		1¼″ Pipe		1½″ Pipe		2″ Pipe	
	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.
1	1.05	2.1	....	....	....	....	....	....	....	....	....	....
2	2.10	7.4	1.20	1.9	....	....	....	....	....	....	....	....
3	3.16	15.8	1.80	4.1	1.12	1.26	....	....	....	....	....	....
4	4.21	27.0	2.41	7.0	1.49	2.14	0.86	0.57	0.63	0.26	....	....
5	5.26	41.0	3.01	10.5	1.86	3.25	1.07	0.84	0.79	0.39	....	....
10	10.52	147.0	6.02	38.0	3.72	11.7	2.14	3.05	1.57	1.43	1.02	0.50
15	....	....	9.02	80.0	5.60	25.0	3.2	6.50	2.36	3.0	1.53	1.08
20	....	....	12.03	136.0	7.44	42.0	4.29	11.1	3.15	5.2	2.04	1.82
25	....	....	....	....	9.30	64.0	5.36	16.6	3.94	7.8	2.55	2.73
30	....	....	....	....	11.15	89.0	6.43	23.5	4.72	11.0	3.06	3.84
35	....	....	....	....	13.02	119.0	7.51	31.2	5.51	14.7	3.57	5.1
40	....	....	....	....	14.88	152.0	8.58	40.0	6.3	18.8	4.08	6.6
45	....	....	....	....	....	....	9.65	50.0	7.08	23.2	4.60	8.2
50	....	....	....	....	....	....	10.72	60.0	7.87	23.4	5.11	9.9
75	....	....	....	....	....	....	....	....	11.80	60.0	7.66	20.9
100	....	....	....	....	....	....	....	....	15.74	102.0	10.21	35.8
120	....	....	....	....	....	....	....	....	18.89	143.0	12 5	50.0
140	....	....	....	....	....	....	....	....	22.04	190.0	14.30	67.0
160	....	....	....	....	....	....	....	....	....	....	16.34	86.0
180	....	....	....	....	....	....	....	....	....	....	18.38	107.0
200	....	....	....	....	....	....	....	....	....	....	20.42	129.0
225	....	....	....	....	....	....	....	....	....	....	....	....
250	....	....	....	....	....	....	....	....	....	....	....	....
275	....	....	....	....	....	....	....	....	....	....	....	....
300	....	....	....	....	....	....	....	....	....	....	....	....
350	....	....	....	....	....	....	....	....	....	....	....	....
400	....	....	....	....	....	....	....	....	....	....	....	....
450	....	....	....	....	....	....	....	....	....	....	....	....
475	....	....	....	....	....	....	....	....	....	....	....	....
500	....	....	....	....	....	....	....	....	....	....	....	....
550	....	....	....	....	....	....	....	....	....	....	....	....
600	....	....	....	....	....	....	....	....	....	....	....	....
650	....	....	....	....	....	....	....	....	....	....	....	....
700	....	....	....	....	....	....	....	....	....	....	....	....
800	....	....	....	....	....	....	....	....	....	....	....	....
900	....	....	....	....	....	....	....	....	....	....	....	....
1000	....	....	....	....	....	....	....	....	....	....	....	....

U.S. Gallons per Minute	2½ Pipe		3″ Pipe		4″ Pipe		5″ Pipe		6″ Pipe		8″ Pipe	
	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.
1	....	....	....	....	....	....	....	....	....	....	....	....
2	....	....	....	....	....	....	....	....	....	....	....	....
3	....	....	....	....	....	....	....	....	....	....	....	....
4	....	....	....	....	....	....	....	....	....	....	....	....
5	....	....	....	....	....	....	....	....	....	....	....	....
10	0.65	0.17	0.45	0.07	....	....	....	....	....	....	....	....
15	0.98	0.36	0.68	0.15	....	....	....	....	....	....	....	....
20	1.31	0.61	0.91	0.25	....	....	....	....	....	....	....	....
25	1.63	0.92	1.13	0.38	....	....	....	....	....	....	....	....
30	1.96	1.29	1.36	0.54	....	....	....	....	....	....	....	....
35	2.29	1 72	1.59	0.71	....	....	....	....	....	....	....	....
40	2.61	2.20	1.82	0.91	1.02	0.22	....	....	....	....	....	....
45	2.94	2.80	2.05	1.15	1.17	0 28	....	....	....	....	....	....
50	3.27	3.32	2.27	1.38	1.28	0.34	....	....	....	....	....	....
75	5.01	7.1	3.4	3.05	1.92	0.73	1.22	0.24	....	....	....	....
100	6.54	12.0	4.54	4.96	2.55	1.23	1.63	0.39	1.14	0.14	....	....
120	7.84	16.8	5.45	7.0	3.06	1. 1	1.96	0.57	1.42	0.25	....	....
140	9.15	22.3	6.35	9.2	3.57	2.28	2.29	0.76	1.58	0.31	....	....
160	10.46	29.0	7.26	11.8	4.08	2.91	2.61	0.98	1.80	0.41	....	....
180	11.76	35.7	8.17	14.8	4.60	3.61	2.94	1.22	2.04	0.50	....	....
200	13.07	43.1	9.08	17.8	5.11	4.37	3.27	1.48	2.28	0.62	....	....
225	14.71	54.3	10.02	22.3	5.77	5.45	3.67	1.86	2.57	0 74	....	....
250	16.03	66.0	11.32	27.2	6.40	6.72	4.08	2.24	2.80	0.92	1.60	0.22
275	18.30	81.0	12.50	32.5	7.03	7.99	4.50	2.72	3.06	1.15	1.73	0.27
300	19.61	92.0	13.62	38.0	7.66	9.30	4.90	3.14	3.40	1.29	1.90	0.32
350	....	....	....	....	8.90	12.32	5.72	4.19	3.98	1.75	2.20	0.42
400	....	....	....	....	10.21	16.00	6.54	5.40	4.54	2.21	2.60	0.54
450	....	....	....	....	11.50	19.80	7.35	6.70	5.12	2.65	2.92	0.68
475	....	....	....	....	12.20	22.96	7.76	7.42	5.55	2.95	3.10	0.76
500	....	....	....	....	12.77	24.00	8.17	8.12	5.60	3.30	3.20	0.82
550	....	....	....	....	....	....	8.99	9.60	6.16	3.93	3.52	0.97
600	....	....	....	....	....	....	9.80	11.30	6.72	4.70	3.84	1.14
650	....	....	....	....	....	....	10.62	13.20	7.28	5.40	4.16	1.34
700	....	....	....	....	....	....	11.44	15.10	7.84	6.20	4.46	1.54
800	....	....	....	....	....	....	....	....	9.08	8.00	5.12	1.97
900	....	....	....	....	....	....	....	....	10.30	10.11	5.75	2.46
1000	....	....	....	....	....	....	....	....	11.32	12.04	6.40	3.02

CAPACITY OF CYLINDERS IN U.S. GALLONS

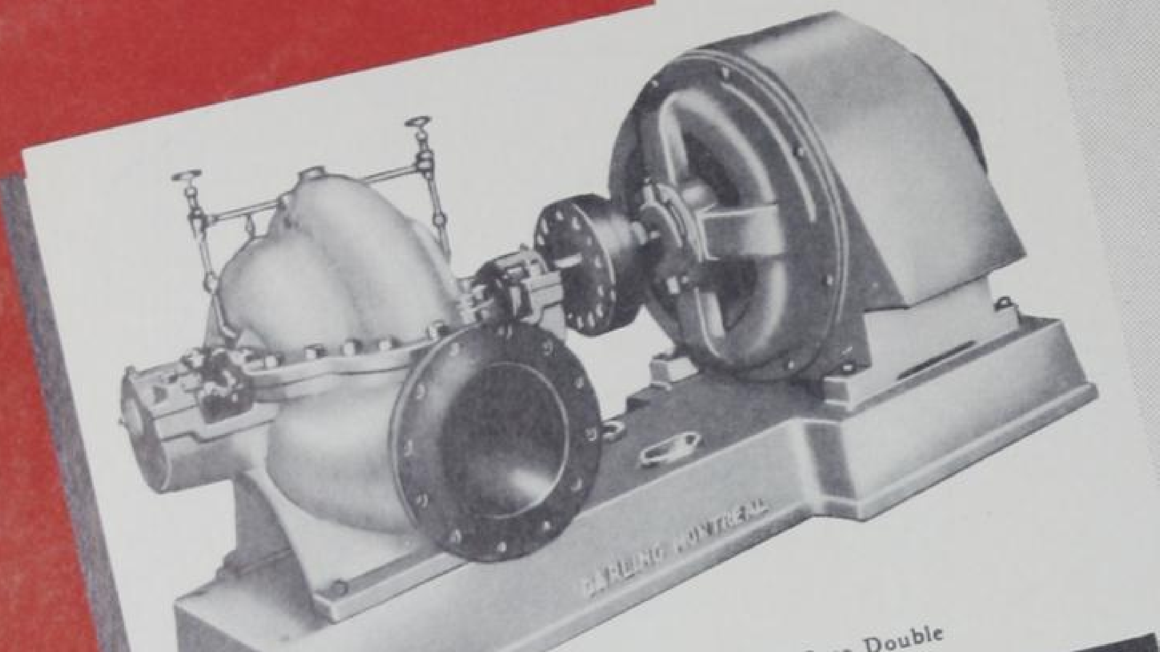
The following table is arranged to show the diameters, length of strokes in inches, with capacities per stroke in U.S. gallons, of Single-Acting Pump Cylinders. To ascertain the capacity of cylinders with longer stroke than listed, add or multiply the capacities of such lengths as will aggregate the length required. To ascertain the amount of water discharged per minute, multiply the capacity as rated per stroke by the number of strokes per minute.

Length of Stroke in Inches, with Capacity of Cylinders, per Stroke, in U. S. Gallons

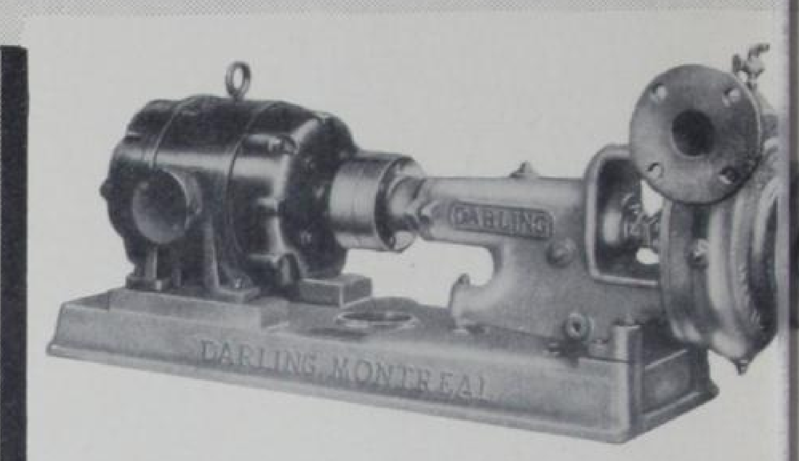
Diam. Pump Cylin. In.	1½	2	3	4	5	6	7	8	9	10
1	.0051	.0068	.0102	.0136	.0170	.0204	.0238	.0272	.0306	.0340
1⅛	.0064	.0086	.0129	.0172	.0215	.0258	.0301	.0344	.0387	.0430
1¼	.0079	.0106	.0159	.0212	.0265	.0318	.0371	.0424	.0477	.0530
1⅜	.0096	.0128	.0192	.0256	.0320	.0384	.0448	.0512	.0576	.0640
1½	.0114	.0152	.0228	.0304	.0380	.0456	.0532	.0608	.0684	.0760
1⅝	.0133	.0178	.0267	.0356	.0445	.0534	.0623	.0712	.0801	.0890
1¾	.0156	.0208	.0312	.0416	.0520	.0624	0728	.0832	.0936	.1041
1⅞	.0178	.0238	.0357	.0476	.0595	.0714	.0833	.0952	.1071	.1190
2	.0204	.0272	.0408	.0544	.0680	.0816	.0952	.1088	.1224	.1360
2¼	.0258	.0344	.0516	.0688	.0860	.1032	.1204	.1376	.1548	.1720
2½	.0318	.0424	.0636	.0848	.1060	.1272	.1484	.1696	.1908	.2120
2¾	.0385	.0514	.0771	.1028	.1285	.1542	.1799	.2056	.2313	.2570
3	.0459	.0612	.0918	.1224	.1530	.1836	.2142	.2448	.2754	.3060
3¼	.0538	.0718	.1077	.1436	.1795	.2154	.2513	.2872	.3231	.3590
3½	.0624	.0832	.1248	.1664	.2080	.2496	.2912	.3328	.3744	.4160
3¾	.0715	.0954	.1431	.1908	.2385	.2862	.3339	.3816	.4293	.4770
4	.0814	.1086	.1629	.2172	.2715	.3258	.3801	.4344	.4887	.5430
4¼	.0919	.1226	.1839	.2452	.3065	.3678	.4291	.4904	.5517	.6130
4½	.1032	.1376	.2064	.2752	.3440	.4128	.4816	.5504	.6192	.6880
4¾	.1150	.1534	.2301	.3068	.3835	.4602	.5309	.6136	.6903	.7670
5	.1273	.1698	.2547	.3396	.4245	.5094	.5943	.6792	.7641	.8490
5¼	.1404	.1872	.2808	.3744	.4680	.5616	.6552	.7488	.8424	.9360
5½	.1542	.2056	.3084	.4112	.5140	.6168	.7196	.8224	.9252	1.0280
6	.1834	.2446	.3669	.4892	6115	.7338	.8561	.9784	1.1007	1.2230
7	.2497	.3330	.4995	.6660	.8325	.9990	1.1655	1.3320	1.4985	1.6650
8	.3262	.4350	.6525	.8700	1.0875	1.3050	1.5225	1.7400	1.9575	2.1750
9	.4129	.5506	.8259	1.1012	1.3765	1.6518	1.9271	2.2024	2.4777	2.7530
10	.5100	.6800	1.0200	1.3600	1.7000	2.0400	2.3800	2.7200	3.0600	3.4000
11	.6169	.8226	1.2339	1.6452	2.0565	2.4678	2.8791	3.2904	3.7017	4.1130
12	.7338	.9784	1.4676	1.9568	2.4460	2.9352	3.4244	3.9136	4.4028	4.8920
13	.8616	1.1488	1.7232	2.2976	2.8720	3.4464	4.0208	4.5952	5.1696	5.7440
14	.9993	1.3324	1.9986	2.6648	3.3310	3.9972	4.6634	5.3296	5.9958	6.6620
15	1.1475	1.5300	2.2950	3.0600	5.8250	4.5900	5.3550	6.1200	6.8850	7.6500
16	1.3050	1.7400	2.6100	3.4800	4.3500	5.2200	6.0900	6.9600	7.8300	8.7000
18	1.6518	2.2024	3.3036	4.4048	5.5060	6.6072	7.7084	8.8096	9.9108	11.0120
20	2.0400	2.7200	4.0800	5.4400	6.8000	8.1600	9.5200	10.8800	12.2400	13.6000
22	2.4681	3.2908	4.9362	6.5816	8.2270	9.8724	11.5178	13.1632	14.8086	16.4540
24	2.9370	3.9160	5.8740	7.8320	9.7900	11.7480	13.7060	15.6640	17.6220	19.5800
26	3.4478	4.5964	6.8946	9.1928	11.4910	13.7892	16.0874	18.3856	20.6838	22.9820
28	3.9979	5.3306	7.9959	10.6612	13.3265	15.9918	18.6571	21.3224	23.9877	26.6530
30	4.5896	6.1194	9.1791	12.2388	15.2985	18.3582	21.4179	24.4776	27.5373	30.5970

Diam. Pump Cylin. In.	12	13	16	18	20	22	24	26	28	30
1	.0408	.0442	.0544	.0612	.0680	.0748	.0816	.0884	.0952	.1020
1⅛	.0516	.0559	.0688	.0774	.0860	.0946	.1032	.1118	.1204	.1290
1¼	.0636	.0689	.0848	.0954	.1060	.1116	.1272	.1378	.1484	.1590
1⅜	.0768	.0832	.1024	.1152	.1280	.1408	.1536	.1664	.1792	.1920
1½	.0912	.0988	.1216	.1368	.1520	.1672	.1824	.1976	.2128	.2280
1⅝	.1068	.1157	.1424	.1602	.1780	.1958	.2136	.2314	.2492	.2670
1¾	.1248	.1452	.1664	.1872	.2082	.2288	.2496	.2904	.2912	.3123
1⅞	.1428	.1547	.1904	.2142	.2380	.2618	.2856	.3094	.3332	.3570
2	.1632	.1768	.2176	.2448	.2720	.2992	.3264	.3536	.3808	.4080
2¼	.2064	.2236	.2752	.3096	.3440	.3784	.4128	.4472	.4816	.5160
2½	.2544	.2756	.3392	.3816	.4240	.4664	.5088	.5512	.5936	.6360
2¾	.3084	.3341	.4112	.4626	.5140	.5654	.6168	.6682	.7196	.7710
3	.3672	.3978	.4896	.5508	.6120	.6732	.7344	.7956	.8568	.9180
3¼	.4308	.4667	.5744	.6462	.7180	.7898	.8616	.9334	1.0052	1.0770
3½	.4992	.5408	.6656	.7488	.8320	.9152	.9984	1.0816	1.1648	1.2480
3¾	.5624	.6201	.7632	.8586	.9540	1.0494	1.1248	1.2402	1.3356	1.4310
4	.6516	.7059	.8688	.9774	1.0860	1.1946	1.3032	1.4118	1.5204	1.6290
4¼	.7356	.7969	.9808	1.1034	1.2260	1.3486	1.4712	1.5938	1.7164	1.8390
4½	.8256	.8944	1.1008	1.2384	1.3760	1.5136	1.6512	1.7988	1.9264	2.0640
4¾	.9204	.9971	1.2272	1.3800	1.5340	1.6874	1.8408	1.9942	2.1476	2.3010
5	1.0188	1.1037	1.3584	1.5282	1.6980	1.8678	2.0376	2.2074	2.3772	2.5470
5¼	1.1232	1.2168	1.4976	1.6848	1.8720	2.0592	2.2464	2.4336	2.6208	2.8080
5½	1.2336	1.3364	1.6448	1.8504	2.0560	2.2616	2.4672	2.6728	2.8784	3.0840
6	1.4676	1.5899	1.9568	2.2014	2.4460	2.6906	2.9352	3.1798	3.4244	3.6690
7	1.9980	2.1645	2.6640	2.9970	3.3300	3.6630	3.9960	4.3290	4.6620	4.9950
8	2.6100	2.8275	3.4800	3.9150	4.3500	4.7850	5.2200	5.6550	6.0900	6.5250
9	3.3036	3.5789	4.4048	4.9554	5.5060	6.0566	6.6072	7.1578	7.7084	8.2590
10	4.0800	4.4200	5.4400	6.1200	6.8000	7.4800	8.1600	8.8400	9.5200	10.2000
11	4.9356	5.3469	6.5808	7.4034	8.2260	9.0486	9.8712	10.6938	11.5164	12.3390
12	5.8704	6.3596	7.8272	8.8056	9.7840	10.7624	11.7408	12.7192	13.6976	14.6760
13	6.8928	7.4672	9.1904	10.3392	11.4880	12.6368	13.7856	14.9344	16.0832	17.2320
14	7.9944	8.6606	10.6592	11.9916	13.3240	14.6564	15.9888	17.3212	18.6536	19.9860
15	9.1800	9.9450	12.2400	13.7700	15.3000	16.8300	18.3600	19.8900	21.4200	22.9500
16	10.4400	11.3100	13.9200	15.6600	17.4000	19.1400	20.8800	22.6200	24.3600	26.1000
18	13.2144	14.3156	17.6192	19.8216	22.0240	24.2264	26.4288	28.6312	30.8336	33.0360
20	16.3200	17.6800	21.7600	24.4800	27.2000	29.9200	32.6400	35.3600	38.0800	40.8000
22	19.7448	21.3902	26.3264	29.6172	32.9080	36.1988	39.4896	42.7804	46.0712	49.3620
24	23.4960	25.4540	31.3280	35.2440	39.1600	43.1760	46.9920	50.9080	54.8240	58.7400
26	27.5784	29.8766	36.7712	41.3676	45.9640	50.5604	55.1568	59.7532	64.3496	68.9460
28	31.9836	34.6489	42.6448	47.9754	53.3060	58.6366	63.9672	69.2978	74.6284	79.9590
30	36.7164	39.7761	48.9552	55.0746	61.1940	67.3134	73.4328	79.5522	85.6716	91.7910

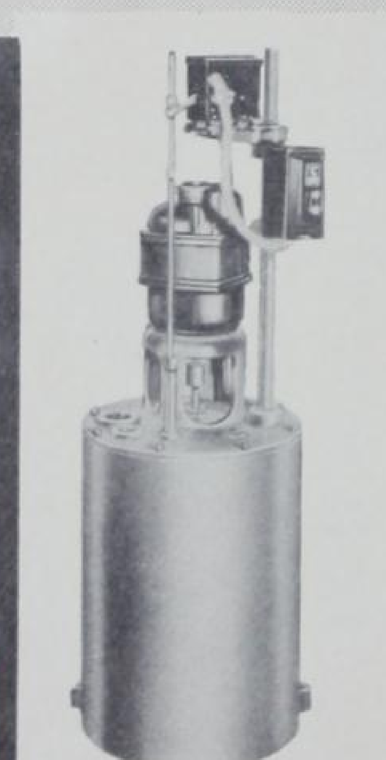
Other Darling Pumps



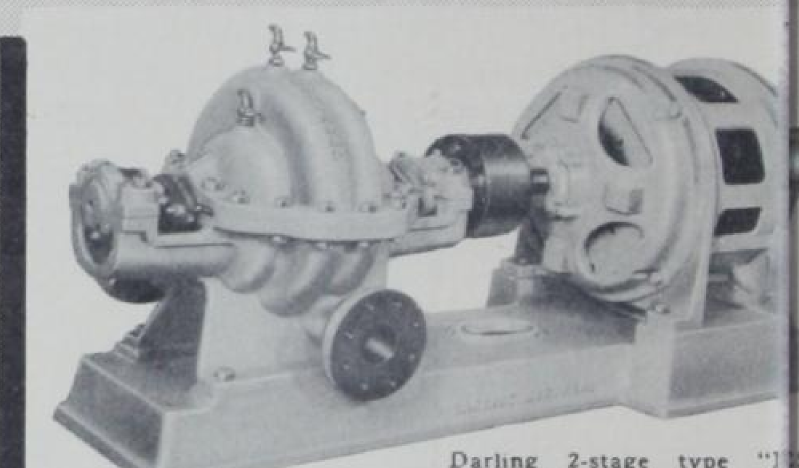
Darling Horizontal Split Case Double Suction Centrifugal Pump.



Darling End Suction Ball Bearing Centrifugal Pump.



Darling type "VC" Vertical Condensation Return Pump.



Darling 2-stage type "J?S" Opposed Impeller Hori?tal Centrifugal Pump.

Darling type "DC" Horizontal Condensation Return Pump.

WE ALSO MANUFACTURE THE FOLLOWING POWER DRIVEN TYPES

Horizontal Split Case Double Suction Multi-Stage.

Horizontal Split Case Single Suction Multi-Stage.

Horizontal End Suction Two Stage Opposed Impeller.

Horizontal Non-Clogging.

Vertical Bilge and Sewage

Vacuum & Boiler Feed.

DARLING BROTHERS LIMITED

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HALIFAX • SAINT JOHN • QUEBEC • ARVIDA • TIMMINS
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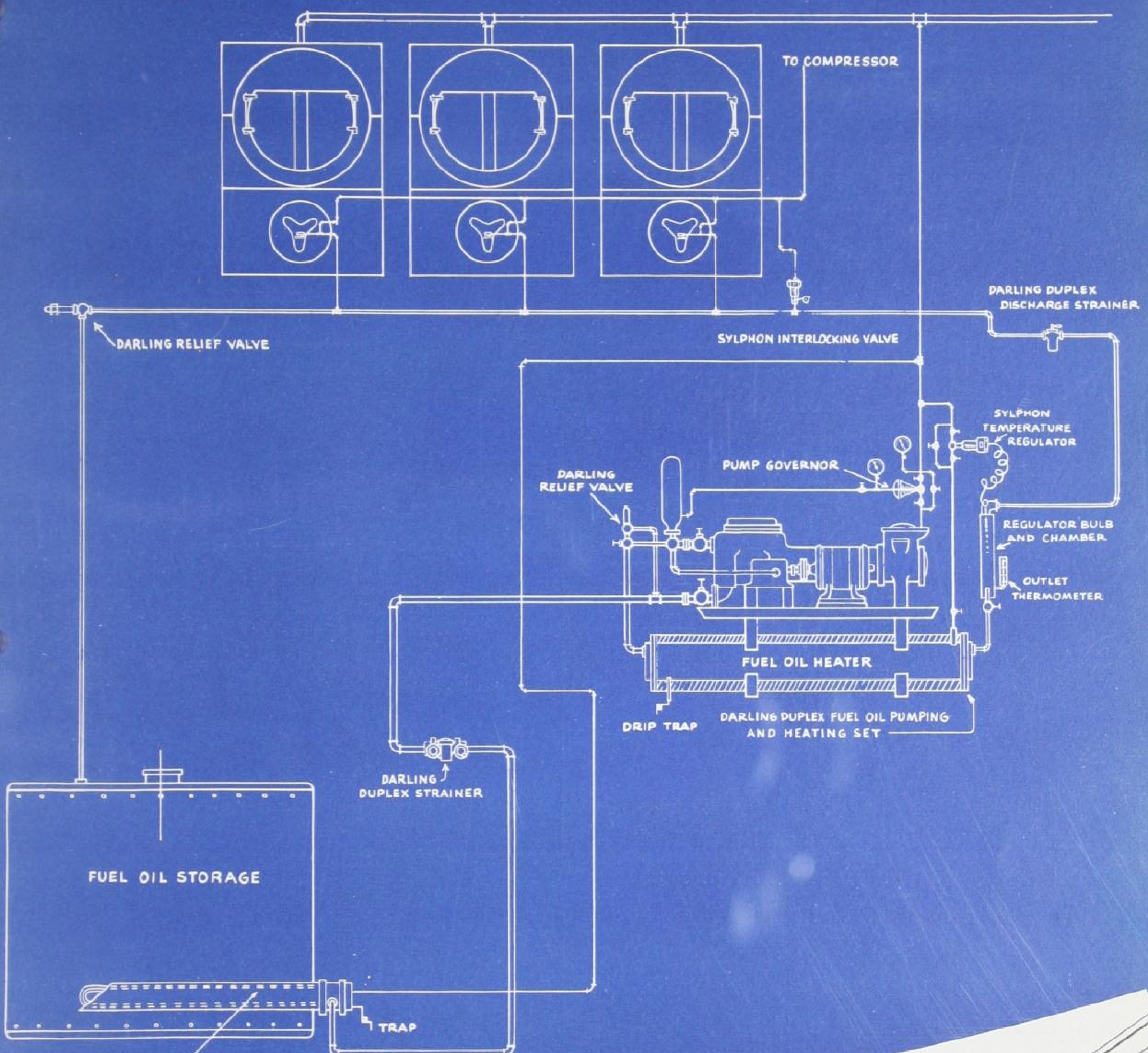
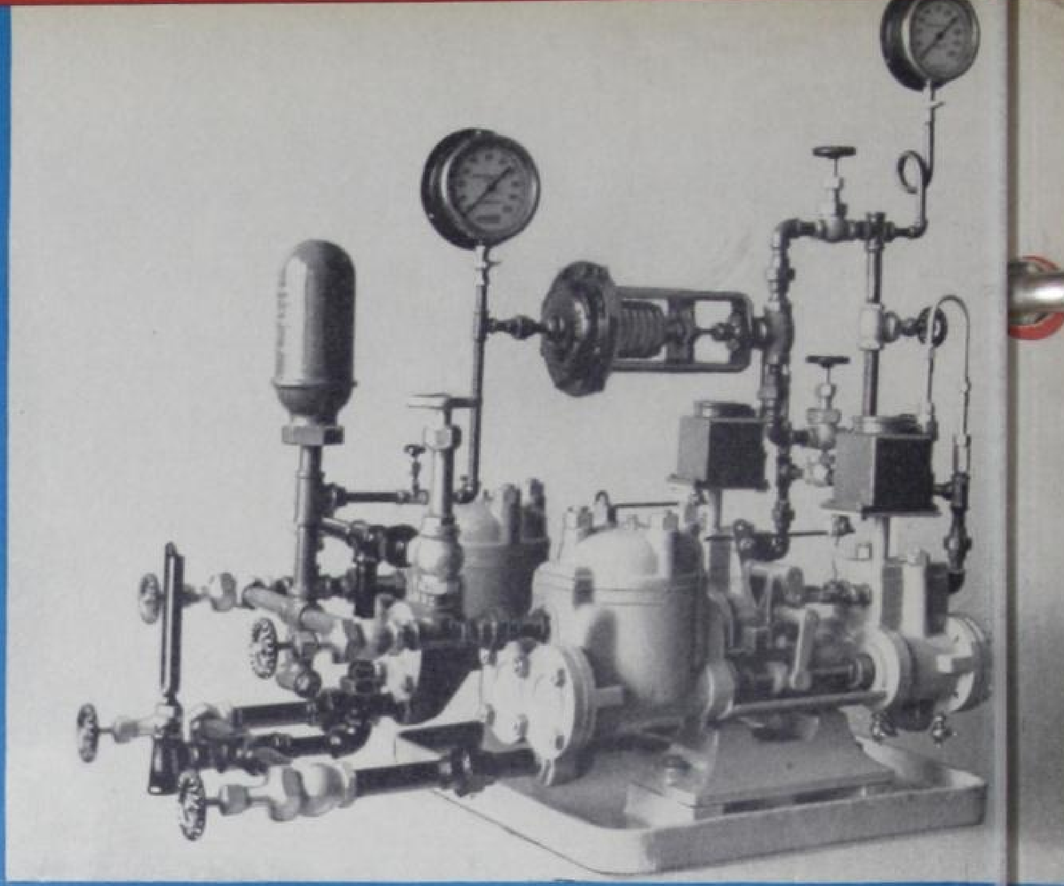


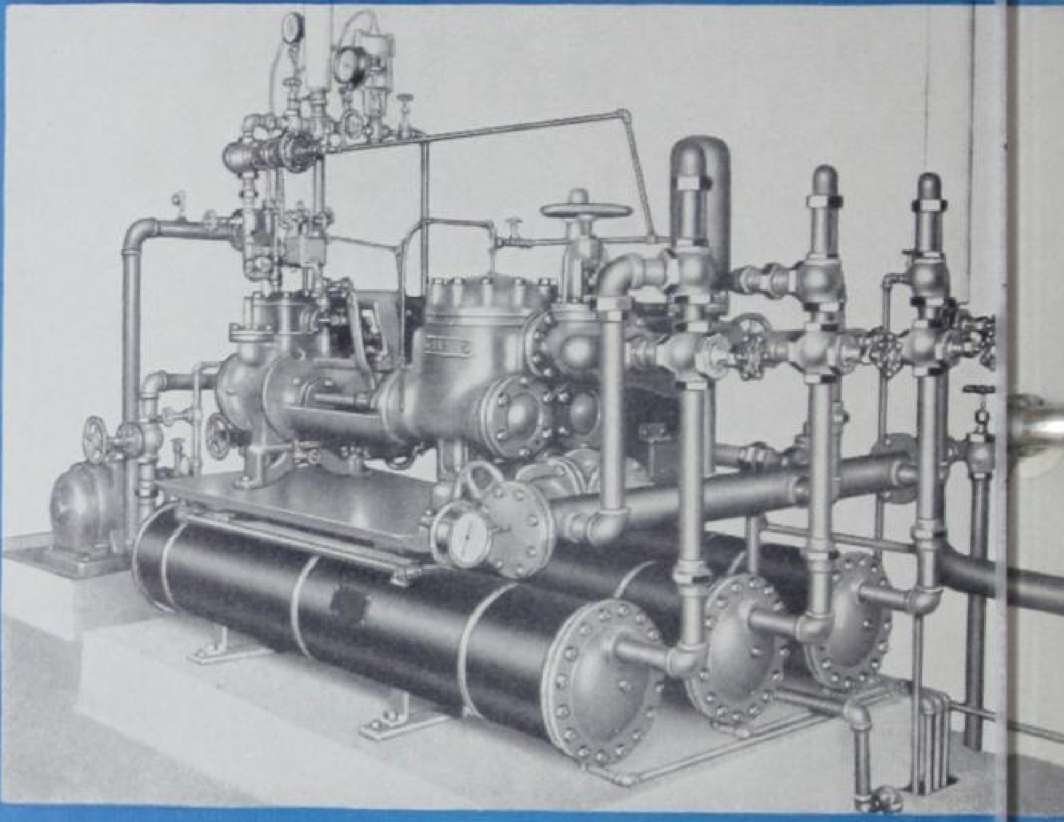
DARLING FUEL OIL BURNING EQUIPMENT

Types of pumping and heating equipment



1

The several types of Darling Twin Fuel Oil Pumping and Heating sets shown represent combinations of equipment that the customer has specified to meet the requirements of a particular fuel oil burning installation. These factors vary from job to job but consist mainly of modifications to pumping equipment, prime movers and controls.

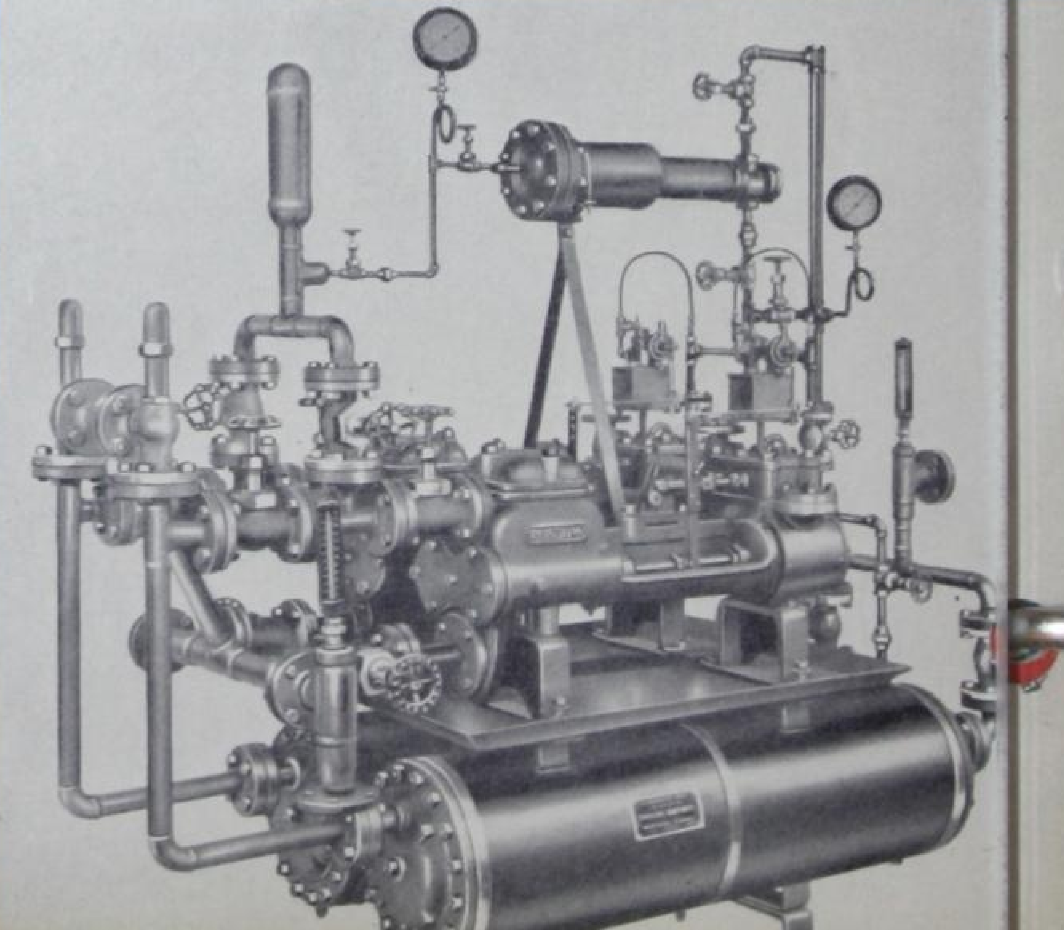


2

1. Darling Fuel Oil Pumping set only, consisting of two Darling Steam-Driven Fuel Oil pumps with pump governor, pressure gauges, thermometer and relief valves.

2. Darling Horizontal Steam-Driven Duplex Fuel Oil Pump, Northern Nitralloy Steel Rotary Fuel Oil Pump with electric drive over three Whitlock-Darling Type "V" Fuel Oil Preheaters, factory assembled.

3. Darling Twin Fuel Oil Pumping and Heating set consisting of two Steam-Driven Fuel Oil pumps and two Whitlock-Darling Fuel Oil heaters with all accessories.



3

pumping and heating set

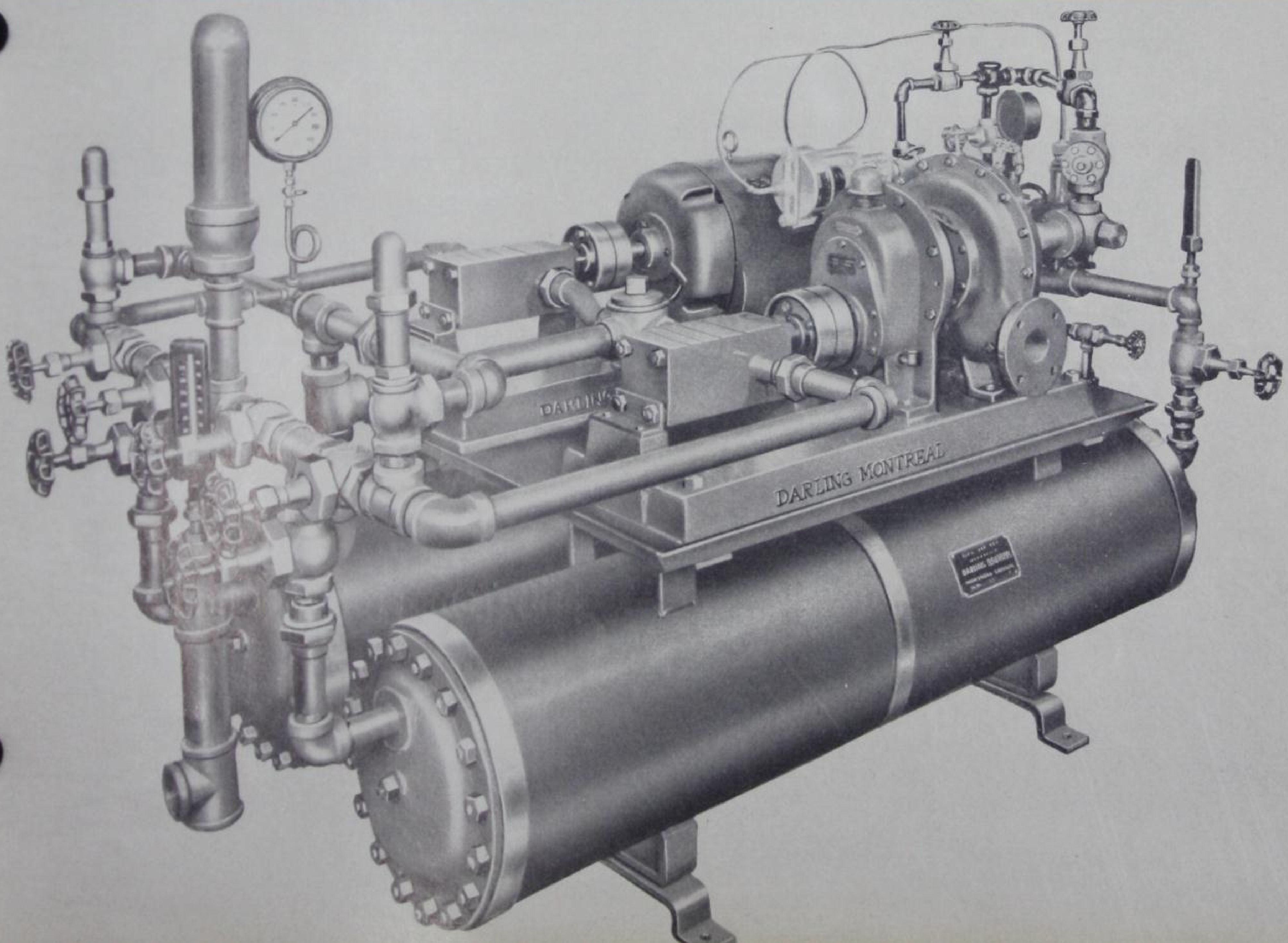
Darling factory-assembled Twin Fuel Oil Pumping and Heating sets help to solve many of the problems arising from the installation of Fuel Oil Burning Equipment. The units are correctly sized to handle with ease the specified capacities, temperature rise and oil pressures.

All piping, valves and fittings necessary to connect the components are carefully fitted by experienced mechanics to assure leak-proof piping systems. The pump and heaters are arranged to operate in any combination that will meet a given operating and load condition.

Accessory equipment includes Darling Oil Relief Valves, Sylphon Temperature Regulators and Pump Governors, Darling Duplex Suction and Discharge Strainers all of which may be assembled into one of these compact ready-to-operate units.

Installation costs can be reduced by the use of Darling Fuel Oil Pumping and Heating Sets, for they eliminate much of the difficult piping on the job site. Darling Pumping and Heating Sets are available in a wide range of capacities and oil pressures.

Photo below shows Combination Electric and Steam Turbine Driven Northern Rotary Fuel Oil Pumps and No. 16 Type "V" Whitlock-Darling Fuel Oil Preheater, comprising a Darling Fuel Oil Pumping and Heating Set supplied to Combustion Engineering Corp. Ltd., for installation at Dominion Bridge Co. Ltd., Lachine, Que.



the preheating of fuel oil

For most effective combustion, fuel oil must be properly atomized at the burner, and atomizing is best effected at one viscosity. Extensive experimentation has shown this viscosity to be 150 seconds Saybolt Universal; similarly 375 seconds Saybolt Furol has been found to give the most desirable pumping viscosity.

With heavier industrial fuel oils, therefore, preheating is necessary before admission to the burner. The temperature to which the oil must be preheated is primarily dependent upon two factors:

First, the viscosity-temperature characteristics of the oil, and

Second, the mechanical design of the burner nozzle.

The first point has been covered above, and for the second point we can say generally that the heat supplied by the heater, plus the heat supplied at the burner, should be sufficient to reduce the relative fluidity of the oil to approximately 150 seconds Saybolt Universal. Thus, steam atomizing and rotary cup burners can accept oils at a higher viscosity than the pressure atomizing burner, since they supply additional heat to the oil at the nozzle.

It is probably well to point out here that, contrary to a belief accepted by some, specific gravity is no index of the viscosity, or of the temperature to which oil should be preheated for proper atomizing. Oils of the same specific gravity may have vastly different viscosities at the same temperature, and the temperature to which one oil must be heated for the best atomizing may be entirely too low for another oil of the same specific gravity.

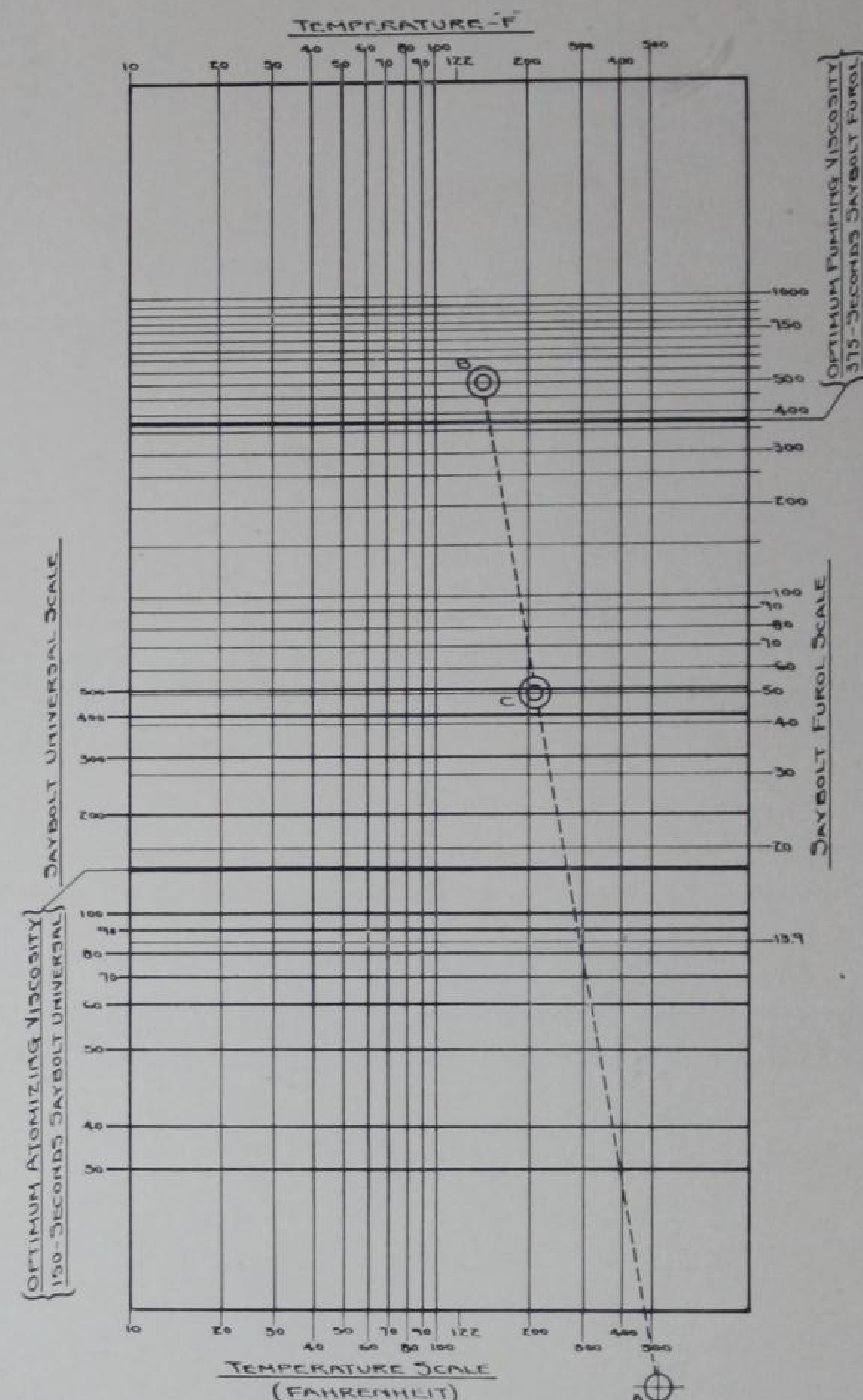


Chart courtesy of Simmons-Boardman Publishing Co.

Fig. 1 — Viscosity-Temperature Characteristics of Fuel Oils.

The Viscosity-temperature characteristics of fuel oils when plotted on a double logarithmic scale, result in straight lines with a common origin — shown above as Point A. Knowing the viscosity of an oil at any one temperature, we can plot this one point and join it with the common point A to obtain the complete viscosity-temperature characteristics.

Example to Show Use of Viscosity-Temperature Chart

KNOWN: Viscosity of Fuel Oil X — 500 seconds Saybolt Furol at 140°F.

WANTED: Temperature required to reduce viscosity to 50 seconds Saybolt Furol.

Plot Point B (500 SSF—140°F.) and join with Point A — intersection with 50 SSF line indicates temperature 210°F. at Point C.

For convenience we have drawn the 150 seconds Saybolt Universal line and the 375 seconds Saybolt Furol line for the optimum atomizing and pumping viscosities, respectively.

whitlock darling fuel oil heaters

(Upper Illustration)
Whitlock-Darling Type "V" all-steel straight tube Fuel Oil Preheater.

(Lower Illustration)
Whitlock-Darling Type "V" Fuel Oil Heater insulated with 2 inches of 85% magnesia, covered with planished steel, secured by brass bands.

EASY CLEANING:—Type V is of a straight tube, fixed sheet design which permits easy mechanical cleaning after merely removing the front and rear heads. The unit has a minimum of joints, with no bolted joints on the steam side. Type V is designed for oil and steam working pressures up to 300 psi. and steam temperatures up to 410°F.

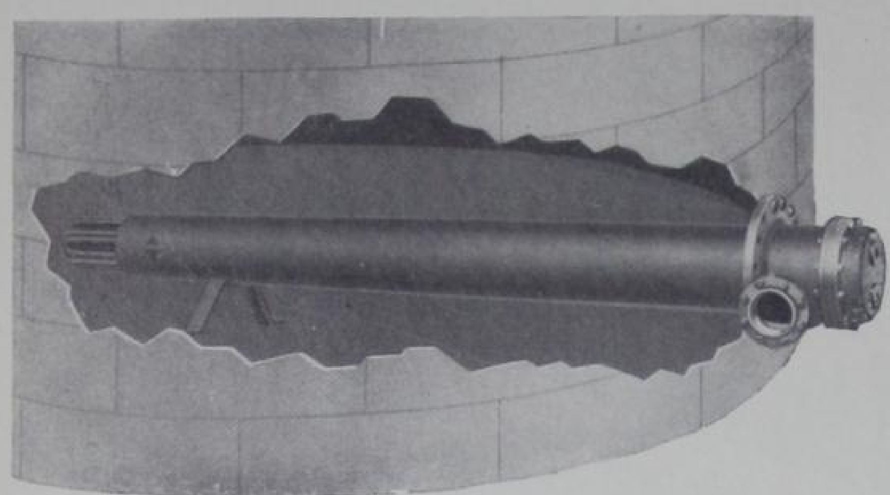
CONSTRUCTION:—**Shells:** Seamless steel pipe. **Tube Sheets:** Rolled steel welded to the shell ends. **Oil Distributing Heads:** Steel or cast iron. **Tubes:** ⅝" O.D. x 16 BWG seamless steel. **Support Brackets:** May be supplied if required.

TABLE I — HEATING CAPACITIES OF TYPE V FUEL OIL HEATERS
IN POUNDS PER HOUR OF BUNKER "C" FUEL OIL

Size or Heater No.	0 PSIG Steam	5 PSIG Steam		25 PSIG Steam			50 PSIG Steam				100 PSIG Steam			
	Temp. Range	Temp. Range		Temp. Range of Oil			Temperature Range of Oil				Temperature Range of Oil			
	90°-175°	90°-175°	90°-200°	90°-175°	90°-200°	90°-225°	90°-175°	90°-200°	90°-225°	90°-250°	90°-175°	90°-200°	90°-225°	90°-250°
3	180	260	160	430	290	190	640	440	320	220	930	660	500	380
4	230	320	200	540	360	240	800	550	400	280	1160	820	630	470
5	280	390	240	650	440	290	960	660	480	340	1400	980	750	570
6	380	515	303	850	570	385	1270	875	635	450	1850	1345	1000	750
7	465	650	380	1165	715	485	1590	1100	800	570	2320	1685	1250	940
8	560	780	465	1280	860	580	1900	1320	960	680	2790	2020	1500	1130
9	750	1030	600	1700	1150	775	2530	1750	1270	900	3710	2690	2000	1500
10	935	1290	755	2130	1430	970	3180	2200	1600	1130	4650	3370	2500	1880
11	1165	1610	940	2580	1780	1210	4000	2740	2000	1410	5800	4200	3100	2350
12	1400	1940	1130	3200	2140	1450	4750	3300	2400	1700	6950	5050	3700	2850
13	1870	2590	1510	4260	2850	1940	6350	4400	3200	2260	9300	6730	5000	3770
14	2330	3230	1890	5330	3570	2430	8000	5500	4000	2830	11600	8420	6200	4700
15	2800	3900	2270	6400	4300	2900	9500	6600	4800	3400	13950	10100	7450	5650
16	3700	5150	3030	8500	5700	3850	12700	8750	6350	4500	18500	13450	10000	7500
17	4650	6500	3800	11650	7150	4850	15900	11000	8000	5700	23200	16850	12500	9400
18	5600	7800	4500	12800	8600	5800	19000	13200	9600	6800	27400	20200	15000	11300
18½	6560	9100	5300	15000	10000	6800	22300	15400	11200	8000	32600	23600	17400	13200
19	7500	10300	6000	17000	11500	7750	25300	17500	12700	9000	37100	26900	20000	15000

Size or Heater No.	125 PSIG Steam				150 PSIG Steam				200 PSIG Steam			
	Temperature Range of Oil				Temperature Range of Oil				Temperature Range of Oil			
	90°-200°	90°-225°	90°-250°	90°-275°	90°-225°	90°-250°	90°-275°	90°-300°	90°-225°	90°-250°	90°-275°	90°-300°
3	720	540	410	320	670	510	360	280	820	640	510	360
4	900	670	510	400	840	640	460	360	1060	800	630	450
5	1080	810	620	480	1000	770	560	440	1240	960	760	540
6	1430	1075	820	630	1330	1030	700	550	1665	1300	1025	720
7	1800	1350	1030	800	1670	1280	870	680	2090	1625	1285	900
8	2150	1620	1240	960	2000	1550	1050	820	2500	1950	1550	1080
9	2870	2150	1640	1280	2670	2050	1400	1080	3330	2600	2050	1440
10	3450	2690	2050	1540	3350	2570	1680	1360	4180	3260	2570	1800
11	4500	3400	2570	2000	4160	3200	2180	1700	5200	4060	3200	2250
12	5370	4000	3100	2400	5000	3850	2620	2040	6250	4900	3850	2700
13	7150	5300	4100	3200	6700	5150	3500	2700	8350	6500	5150	3600
14	9000	6750	5150	4000	8350	6400	4370	3400	10400	8130	6400	4500
15	10750	8070	6200	4800	10000	7700	5250	4050	12500	9800	7750	5400
16	14300	10750	8200	6300	13300	10300	7000	5500	16650	13000	10250	7200
17	18000	13500	10300	8000	16700	12800	8700	6800	20400	16250	12850	9000
18	21500	16200	12400	9600	20000	15500	10500	8200	25000	19500	15500	10300
18½	25300	18900	14500	11200	23400	18000	12200	9500	29300	22800	18000	12600
19	28700	21500	16400	12800	26700	20500	14000	10800	33300	26000	20500	14400

whitlock-darling fuel oil preheater suction type



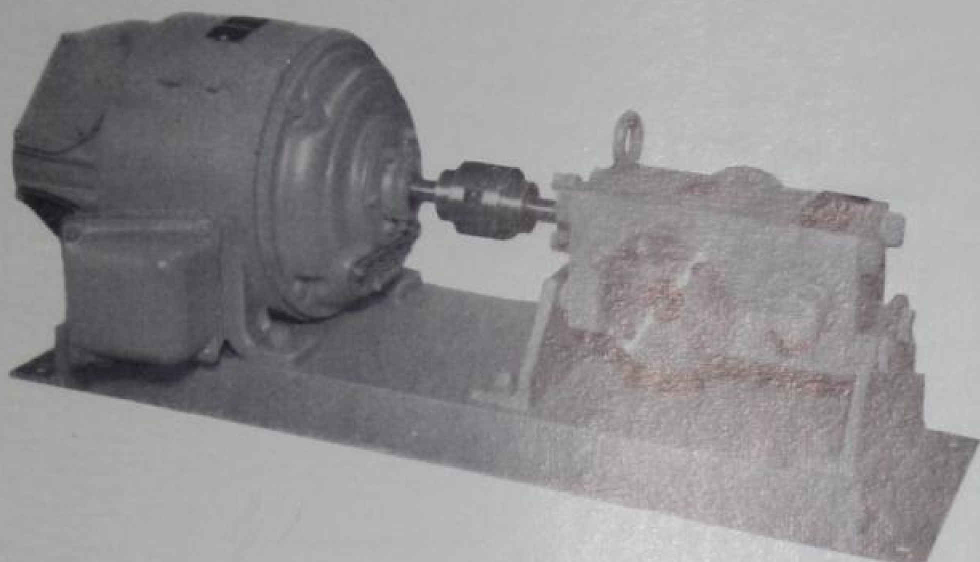
This heater can be used to heat any grade of oil up to a temperature at which it will flow readily to facilitate its withdrawal from large storage tanks. Since the oil is heated only as it is drawn off, it is not necessary to maintain the contents of the whole tank in a heated condition. This reduces radiation losses to a minimum. The entire heating element, with the exception of a few inches of the upper surface at the far end, is enclosed in a steel sheath through which the oil is drawn from the tank. The tubes are medium size seamless steel made up in the form of U-bends, with the ends expanded into a rolled steel tube sheet. The steam distributing chamber which directs steam through the tubes is of cast iron or cast steel depending on the steam pressure. The heater is furnished complete ready for welding, riveting, or bolting to the storage tank as may be required. The use of collar studs enables the head to be removed for inspection of the tubes without draining the storage tank. Capacities are based on heating Bunker C oil from 20°F. to 100°F. with steam at 100 psi. Tank dimensions should be given when requesting prices.

Preheaters for Vertical installation are made to suit individual requirements.

TABLE II — CAPACITIES and DIMENSIONS — WHITLOCK-DARLING HORIZONTAL SUCTION TYPE FUEL OIL PREHEATERS

Size No.	Capacity Lbs./Hr.	Diam. Head Flange	Approx. Overall Length	Minimum Diam. of Opening in Tank	Diam. of Plain Tank Attachment Flanges	Oil Connections	Steam Connections	Cond. Connections
3	580	10¼″	1′-11″	7″	13″	¾″	¾″	¾″
4	750	10¼″	2′-4″	7″	13″	¾″	¾″	¾″
5	910	10¼″	2′-9″	7″	13″	1″	¾″	¾″
6	1,200	10¼″	3′-6″	7″	13″	1″	¾″	¾″
7	1,500	10¼″	4′-4″	7″	13″	1″	¾″	¾″
8	1,800	10¼″	5′-1″	7″	13″	1½″	¾″	¾″
9	2,400	10¼″	6′-8″	7″	13″	1½″	¾″	¾″
10	3,000	13¼″	4′-4″	9″	16″	1½″	¾″	¾″
11	3,700	13¼″	5′-4″	9″	16″	2″	¾″	¾″
12	4,500	13¼″	6′-4″	9″	16″	2″	¾″	¾″
13	6,000	13¼″	7′-3″	9″	16″	2½″	¾″	¾″
14	7,500	16¼″	7′-11″	11″	19″	2½″	¾″	¾″
15	9,200	16¼″	9′-4″	11″	19″	3″	¾″	¾″
16	12,000	16¼″	12′-3″	11″	19″	3″	¾″	¾″
17	15,000	19¼″	8′-0″	14¼″	22″	4″	¾″	¾″
18	18,000	19¼″	9′-7″	14¼″	22″	4″	¾″	¾″
18½	21,000	19¼″	11′-1″	14¼″	22″	4″	¾″	¾″
19	24,000	19¼″	12′-6″	14¼″	22″	5″	1″	1″
19½	27,000	22¼″	10′-0″	16¼″	25″	5″	1″	1″
20	30,000	22¼″	12′-0″	16¼″	25″	5″	1¼″	1¼″
21	37,000	25¼″	9′-11″	20½″	28″	6″	1¼″	1¼″
22	45,000	25¼″	11′-9″	20½″	28″	6″	1¼″	1¼″
23	60,000	29¼″	11′-0″	24½″	32″	8″	1½″	1¼″
24	75,000	29¼″	13′-6″	24½″	32″	8″	1½″	1½″

northern rotary fuel oil pump series 4000



The Northern Series 4000 Rotary Fuel Oil Pump is fabricated of Nitralloy Steel and built to extreme fine limits of accuracy. It offers the known value of quick and convenient interchangeability of component parts. Available in a wide range of capacities and for pressures up to 300 lbs. Used as standard equipment on Darling Fuel Oil Pumping and Heating Sets. Pumps can be supplied with either electric or steam Turbine Drive.

Northern Rotary Gear Pumps Specifications for Handling Bunker "C" Fuel Oil

Viscosities of 1000 to 5000 SSU. Maximum suction lift 15" Hg.

TABLE III — CAPACITIES IN U.S. GPM AT 1150 RPM

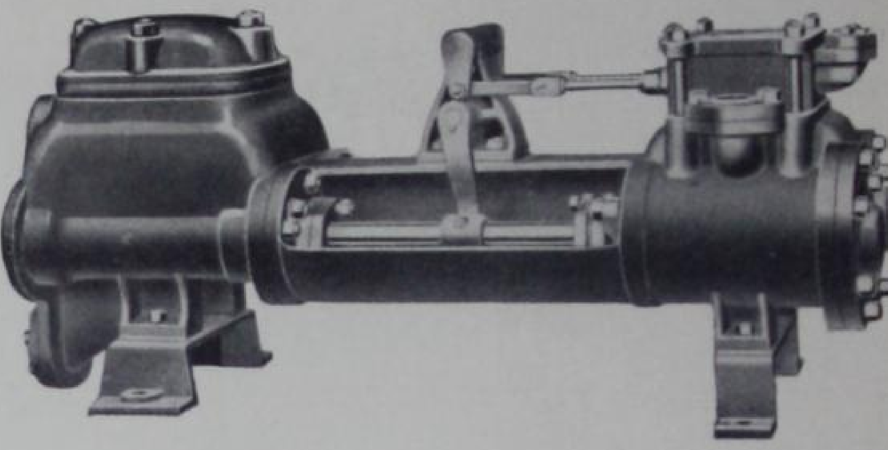
Discharge 100 PSI				Discharge 200 PSI				Discharge 300 PSI			
GPM	Pump Size	Pump Speed RPM	BHP	GPM	Pump Size	Pump Speed RPM	BHP	GPM	Pump Size	Pump Speed RPM	BHP
.39	4300-02	1150	.19	.37	4300-02	1150	.21	.35	4300-02	1150	.23
.77	4300-04	1150	.22	.74	4300-04	1150	.30	.71	4300-04	1150	.36
1.16	4300-06	1150	.28	1.12	4300-06	1150	.35	1.08	4300-06	1150	.43
1.55	4300-08	1150	.40	1.48	4300-08	1150	.5	1.42	4300-08	1150	.6
1.94	4400-05	1150	.47	1.86	4400-05	1150	.63	1.78	4400-05	1150	.74
2.9	4400-07	1150	.57	2.78	4400-07	1150	.75	2.66	4400-07	1150	.95
3.9	4400-10	1150	.65	3.73	4400-10	1150	.98	3.56	4400-10	1150	1.2
5.8	4400-15	1150	1.0	5.55	4400-15	1150	1.3	5.35	4400-15	1150	1.7
7.78	4400-20	1150	1.3	7.45	4400-20	1150	1.7	7.13	4400-20	1150	2.3
4.55	4500-07	1150	.85	4.36	4500-07	1150	1.2	4.17	4500-07	1150	1.4
6.07	4500-10	1150	1.0	5.81	4500-10	1150	1.35	5.58	4500-10	1150	1.8
9.1	4500-15	1150	1.4	8.74	4500-15	1150	1.9	8.35	4500-15	1150	2.5

TABLE IV — CAPACITIES IN U.S. GPM AT 850 RPM

Discharge 100 PSI				Discharge 200 PSI				Discharge 300 PSI			
GPM	Pump Size	Pump Speed RPM	BHP	GPM	Pump Size	Pump Speed RPM	BHP	GPM	Pump Size	Pump Speed RPM	BHP
7.47	4600-07	850	1.5	7.15	4600-07	850	2.0	6.85	4600-07	850	2.5
9.9	4600-10	850	2.0	9.5	4600-10	850	2.6	9.1	4600-10	850	3.2
15.2	4600-15	850	3.0	14.3	4600-15	850	3.9	13.6	4600-15	850	4.8
20.0	4600-20	850	4.0	19.2	4600-20	850	5.0	18.3	4600-20	850	6.3
24.8	4600-25	850	4.9	23.8	4600-25	850	6.3	22.8	4600-25	850	7.7
37.0	4700-30	850	6.5	35.5	4700-30	850	8.5	34.0	4700-30	850	10.7
49.5	4700-40	850	8.0	47.5	4700-40	850	11.0	45.5	4700-40	850	14.7
54.0	4800-30	850	9.0	51.8	4800-30	850	12.2	49.6	4800-30	850	15.4
72.0	4800-40	850	11.8	69.0	4800-40	850	16.0	66.0	4800-40	850	20.0
90.0	4800-50	850	15.0	86.0	4300-50	850	26.5				
108.0	4800-60	850	16.5								

darling steam pumps

The Darling Horizontal Duplex Steam-Driven Fuel Oil Pump has many features especially designed for pumping commercial grades of Fuel Oil.



These include snap ring plungers in the oil end and "Durabla" metal valves as standard fittings. Steel Liners and Stainless Steel Piston rods can be supplied if required.

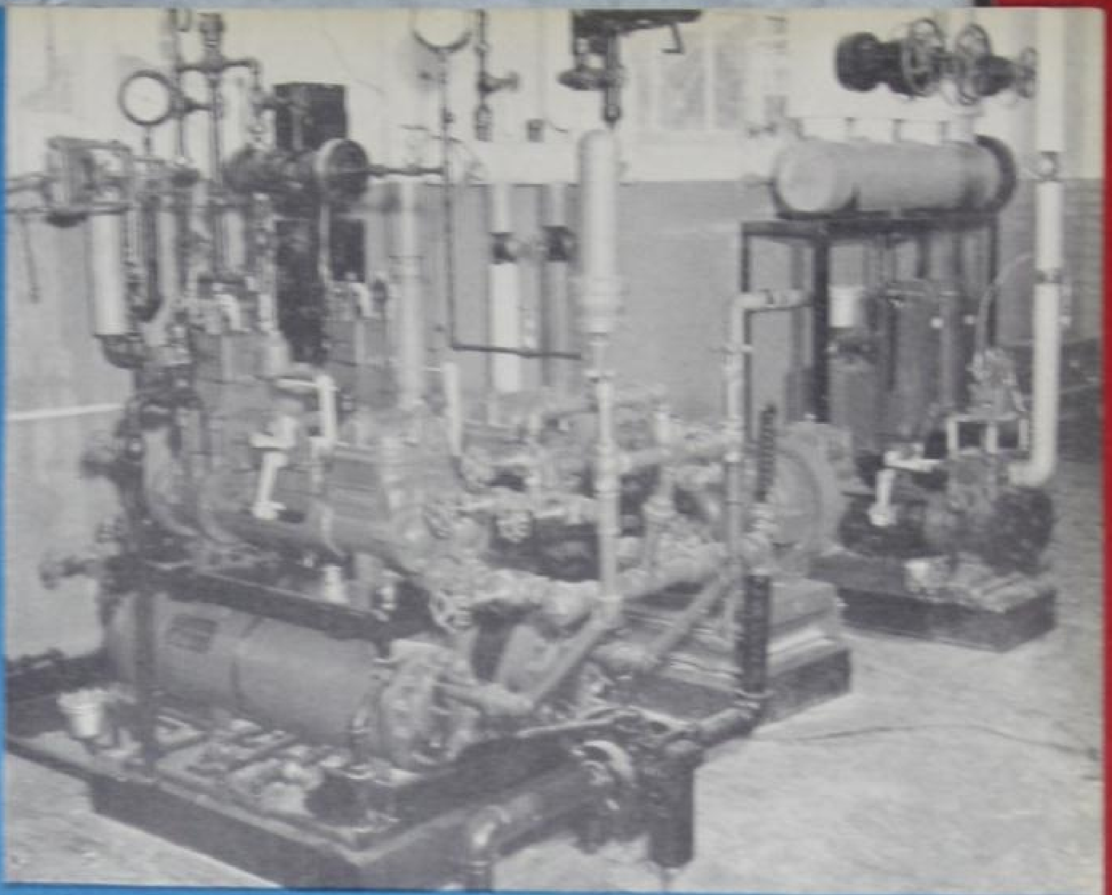
The attention to detail and the expert workmanship built into these pumps is proved by their wide acceptance in Fuel Oil applications. Available for oil pressures to 300 lbs. per square inch and steam pressures to 175 lbs.

TABLE V — CAPACITIES OF DARLING DUPLEX HORIZONTAL FUEL OIL PUMPS IN U.S. GPM

Size	U.S. Gallons per Stroke each Cylinder		At Single Strokes Each Side Per Minute: Fuel Oil 20	25	30	Tank Service 35	40	50	60	70	80	90	100	110	Emergency 120	Size Pipe Connections: Steam	Exhaust	Suction	Discharge	Floor Space: Length	Width	Height	Weight
3 x2 x 3	.041	U.S.G. P.M.	1.64	2	2.46	2.87	3.28	4.1	4.9	5.7	6.5	7.4	8.2	9.02	9.8	*3/8	*1/2	*1¼	*1	26	9½	13	125
4½x2¾x 4	.103	U.S.G. P.M.	4.1	5.1	6.1	7.2	8.2	10.3	12.3	14.4	16.5	18.5	20.6	22.6	24.7	*1/2	*3/4	*2	*1½	36	12½	17	330
5¼x3½x 5	.208	U.S.G. P.M.	8.3	10.4	12.5	14.5	16.6	20.8	24.9	29.1	33.2	37.4	41.6	45.7	5.0	*1	*1¼	*2½	*1½	43	16	17	550
6 x4 x 6	.326	U.S.G. P.M.	13	16.3	19.5	22.8	26	32.6	39.1	45.6	52.1	58.6	65	71.7	78.2	*1	*1½	*3	*2	46	16	22	700
7½x4½x 8	.551	U.S.G. P.M.	22	27.5	33	38.6	44	55.1	66.1	77.1	88.2	99.2	110.2	121.2	132.2	*1½	*2	†4	†3	63	23	29	1500
7½x4½x10	.689	U.S.G. P.M.	27.5	34.4	41.3	48.2	55.1	68.9	82.6	96.4	110	124	138	151	165	*1½	*2	†4	†3	60	21	29	1650
7½x5 x10	.850	U.S.G. P.M.	34	42.5	51	59.5	68	85	102	119	136	153	170	187	204	*1½	*2	†4	†3	62	21	29	1675
10 x6 x10	1.224	U.S.G. P.M.	48.9	61	73	85	98	122	147	171	196	220	245	269	294	*2	*2½	†5	†4	66	26	32	1950
12 x7 x12	2.	U.S.G. P.M.	80	100	120	140	160	200	240	280	320	360	400	440	480	*2½	*3	†6	†5	79	32	35	2250

*Screwed Connection †Flanged Connection

Installations of fuel oil pumping and heating sets



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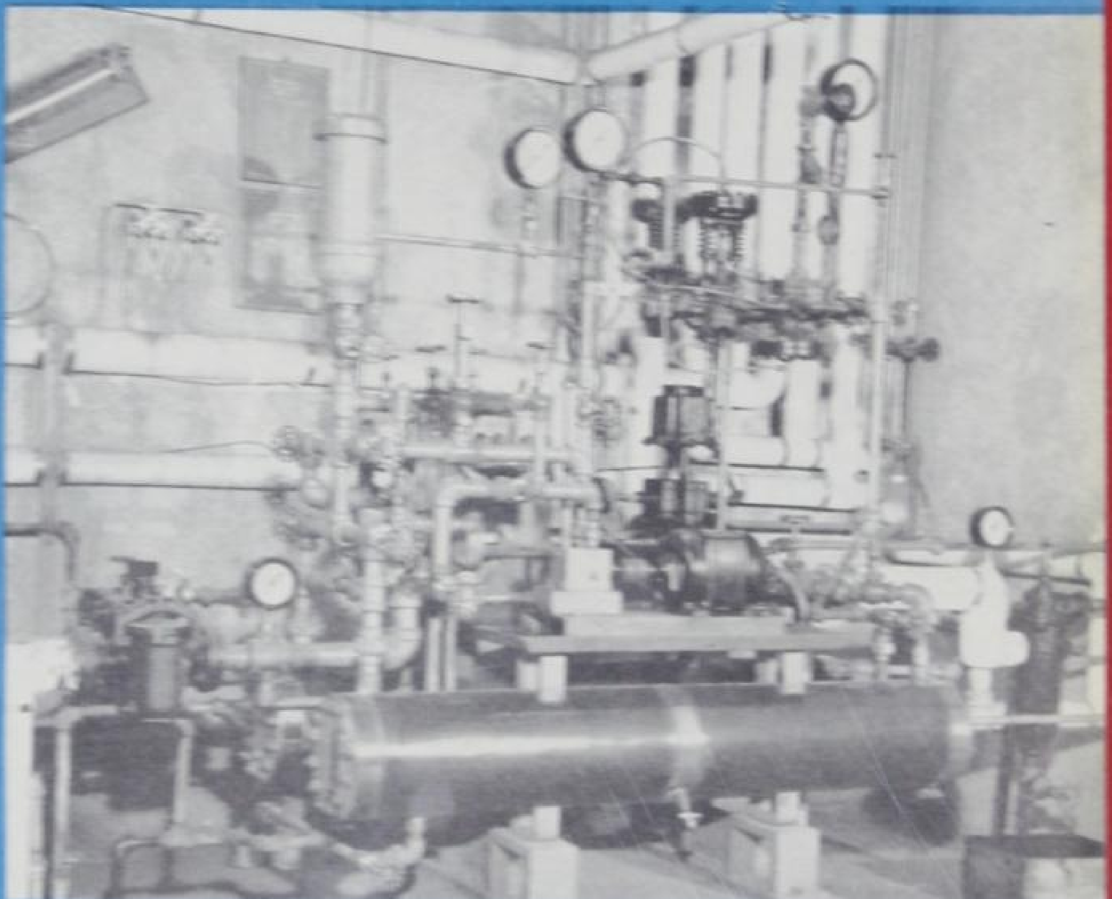

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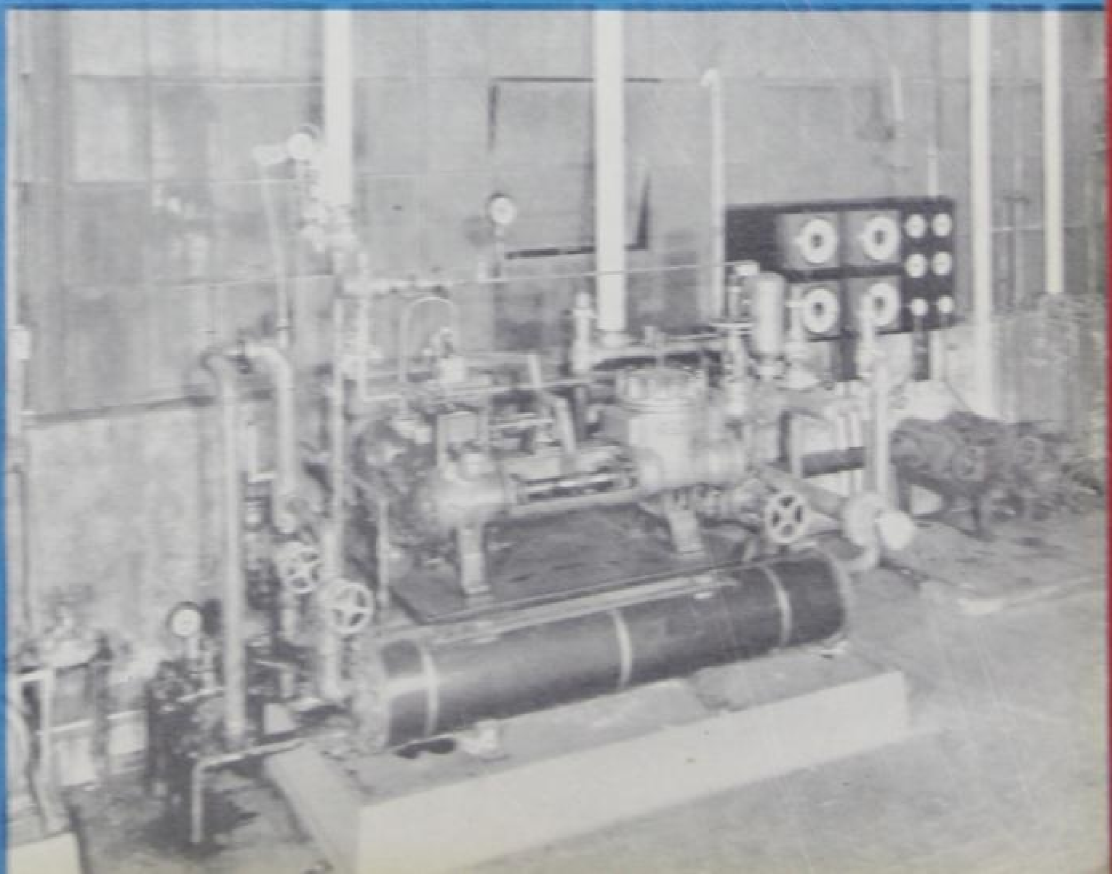


3

1. *National Cellulose of Canada Limited, Toronto, Ont.* — Unit consisting of two 4 ½" x 2¾" x 4" Darling Horizontal Duplex Steam-Driven Fuel Oil Pumps over two Whitlock-Darling Type "V" Fuel Oil Preheaters. Accessories include No. 931 Sylphon Temperature Regulator, Fisher Pump Governor, Darling Oil Relief Valves and Duplex Suction Strainer.

2. *St. Joseph's Hospital, Lachine, Que.* — Unit includes 3" x 2" x 3" Darling Horizontal Fuel Oil Pump series 4000 electric-driven Northern Nitralloy Steel Rotary Fuel Oil Pump over two Whitlock-Darling special type Fuel Oil Preheaters. Accessory equipment includes Spence Temperature Regulator and Spence Governor, Darling Oil Relief Valves.

3. *Montreal Locomotive Works, Montreal, Que.* — Unit consisting of one 7 ½" x 4 ½" x 8" Darling Horizontal Duplex Steam Pump, one series 4000 electric-driven Northern Nitralloy Steel Rotary Fuel Oil Pump over three Whitlock-Darling Fuel Oil Heaters. Accessory equipment includes No. 931 Sylphon Temperature Regulator, Fisher Pumps Governor, Darling Oil Relief Valves, Darling Duplex Suction and Discharge Strainers.

darling bronze oil relief valves

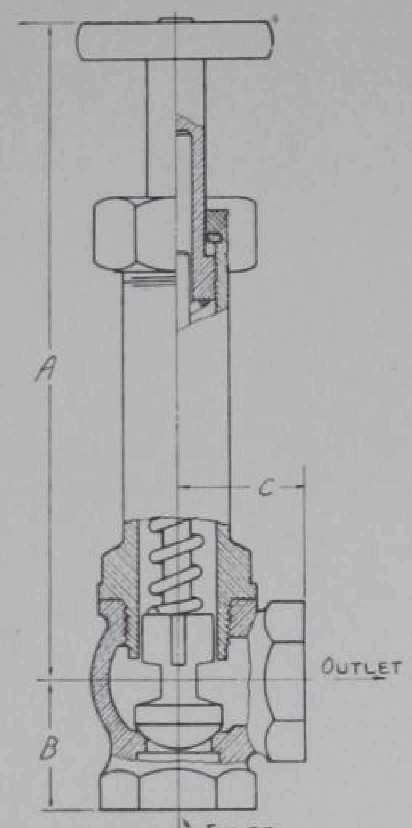


Fig. 2

Automatic regulating with ball seat design valve. There are no guides to block the por area and the spherical valve is self cleaning. Available in both the hand wheel adjustin or protected bonnet types. The latter for use where a permanent adjustment is required t maintain a fixed pressure release. The extra long spring assures smooth pressure regulatio free from chattering. Springs are readily interchangeable to provide a wide range of pressur adjustment.

TABLE VI

Size	A	B	C
$\frac{3}{4}''$	$8\frac{3}{16}$	$1\frac{3}{4}$	$1\frac{3}{4}$
$1''$	$8\frac{3}{16}$	$1\frac{3}{4}$	$1\frac{3}{4}$
$1\frac{1}{4}''$	$9\frac{3}{8}$	$2\frac{3}{16}$	$2\frac{3}{16}$
$1\frac{1}{2}''$	$9\frac{3}{8}$	$2\frac{3}{16}$	$2\frac{3}{16}$
*$2''$	12	$3\frac{1}{8}$	$3\frac{1}{8}$
*$2\frac{1}{2}''$	12	$3\frac{1}{8}$	$3\frac{1}{8}$

*Bonnet Type Only

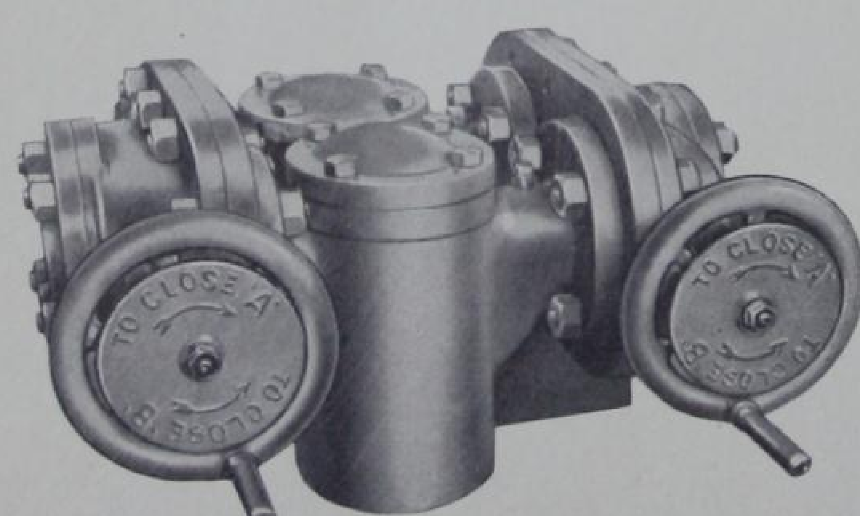
All dimensions in inches.

HAND WHEEL ADJUSTMENT

BONNET TYPE

darling duplex suction strainers

type "W"



The duplex suction strainer shows to greatest advantage where continuous operation is required; it is possible to shut off one strainer and use the other, permitting the first one to be cleaned and made ready in a few moments for future use.

Of rugged design, it is a dependable unit and often used suction lines from oil tanks and other special applicatior Made in sizes from 4" to 8".

Companion flanges included as part of the unit.

Maximum working pressure 15 lbs. per sq. in.

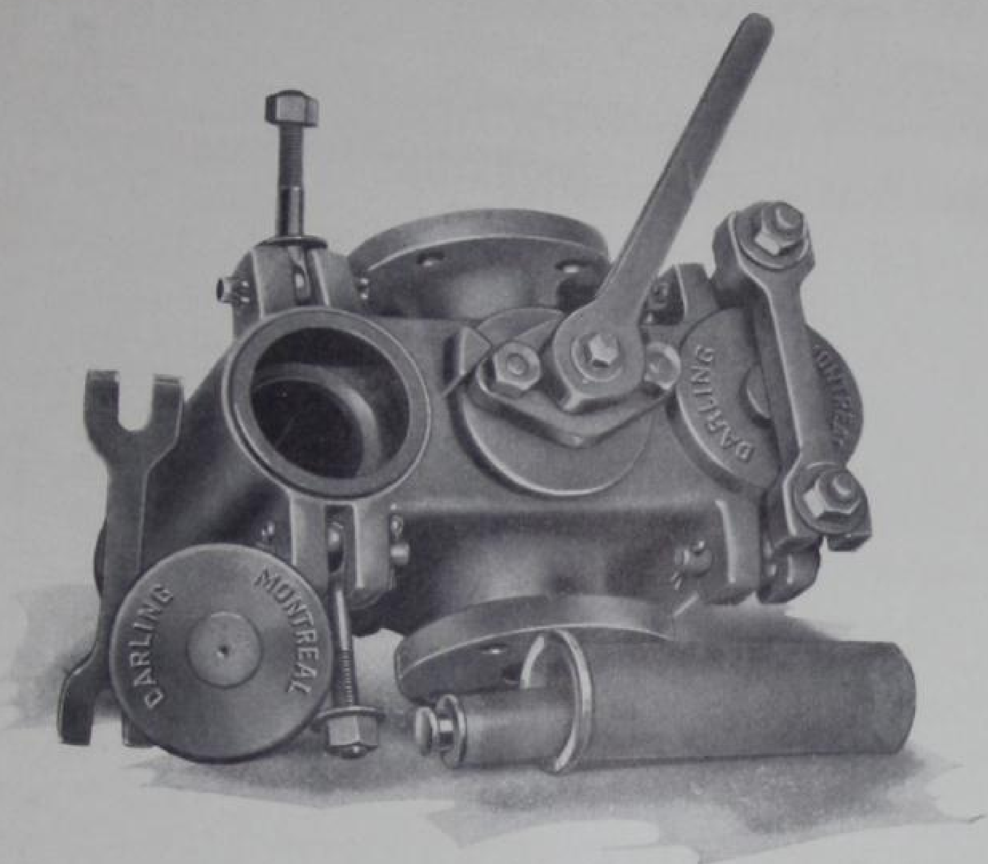
TABLE VII — DIMENSIONS OF DARLING DUPLEX STRAINE

Size	Face to Face	Overall Width	Overall Height	Extra space for strainer removal	Weigh lbs.
4	24	28	$16\frac{5}{8}$	$14\frac{5}{8}$	60[illegible]
5	$28\frac{1}{8}$	$32\frac{1}{4}$	$19\frac{7}{8}$	$14\frac{1}{4}$	79[illegible]
6	30	34	$21\frac{1}{2}$	$15\frac{1}{4}$	95[illegible]

All dimensions in inches.

darling duplex discharge strainers

type "D"



This cast iron duplex strainer has a wide application in many industries, but is particularly suited to Fuel Oil Burning installations.

The principal advantages of Darling Type "D" Duplex Strainers are as follows:

No valves — a 90-degree turn of the handle changes from one basket to the other.

Positive adjustment of tapered plug valve by means of jack screw.

Strainer basket being in two parts is more readily cleaned.

TABLE VIII

Size	A	B	C	D
1 ½″	8 ¾″	12″	7 ½″	10″
2″	10 ⅜″	16″	8″	12″
2 ½″	12″	18″	10″	13 ½″
3″	13″	19″	12″	17″

Double basket (the combined area of whose perforations is from six to ten times the cross sectional area of the pipe and about twice the area of other makes of strainers).

Designed so that when well cover is removed, level of liquid in well is lowered, exposing top of basket for removal. Connection provided at base for draining oil if required.

Handle partially covers basket-well which is in use, leaving exposed the well which is out of commission and free to be cleaned. In no position of handle is it possible to stop the flow. Maximum working pressure 100 lbs. Also available in cast bronze or cast steel for higher pressures if required.

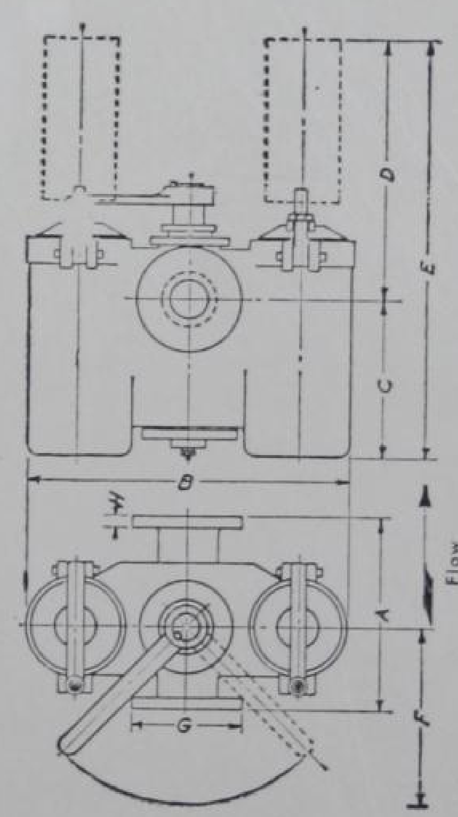
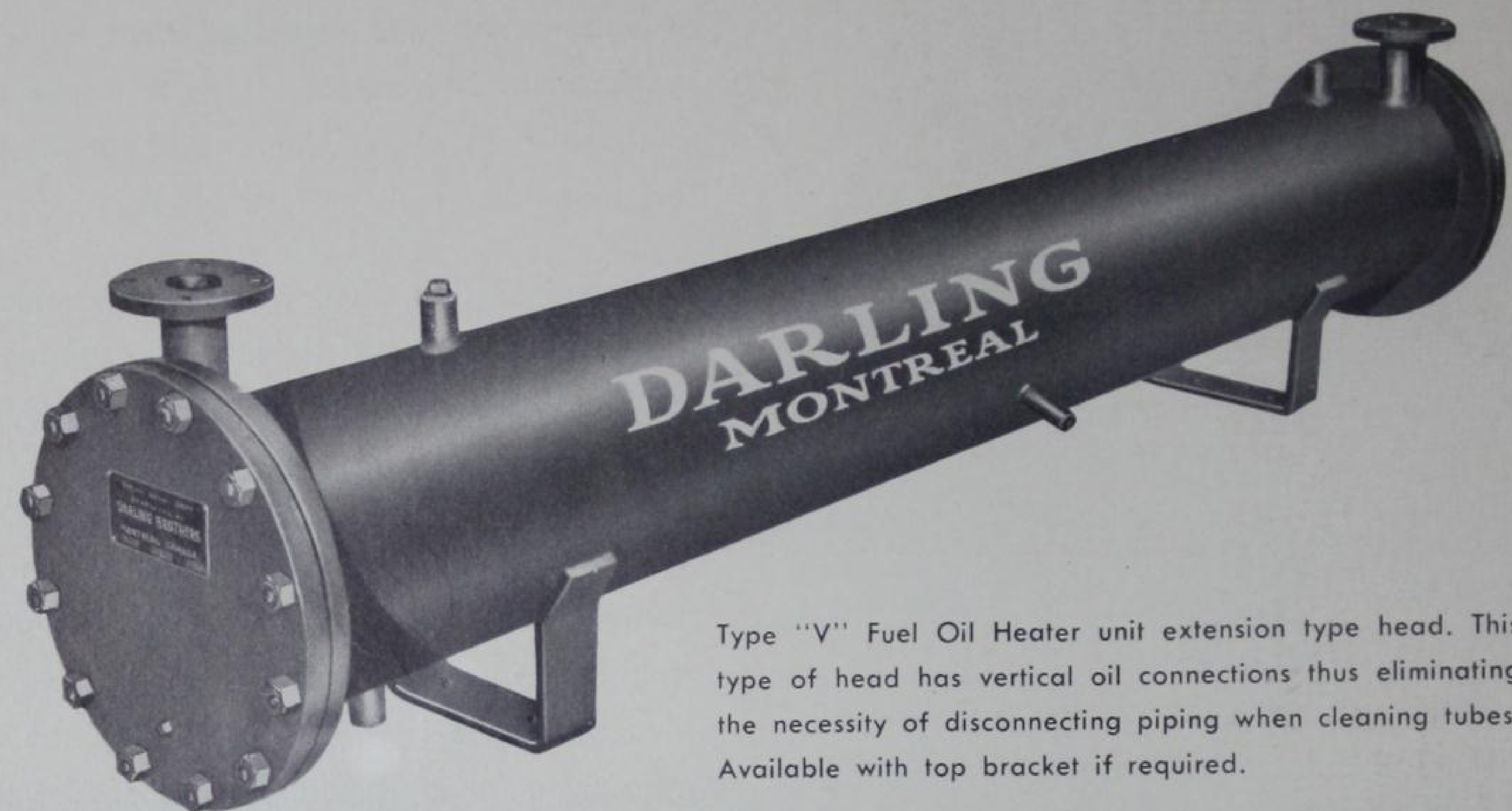


Fig. 3

whitlock-darling special type "V" fuel oil heater



Type "V" Fuel Oil Heater unit extension type head. This type of head has vertical oil connections thus eliminating the necessity of disconnecting piping when cleaning tubes. Available with top bracket if required.

BRANCH OFFICES AND REPRESENTATIVES

HALIFAX, N.S.
E. S. Stephenson & Co. Ltd. .... 155 Granville Street

SAINT JOHN, N.B.
E. S. Stephenson & Co. Ltd. .... 15 Dock Street

QUEBEC, P.Q.
W. J. Banks .... 140 St. John Street

ARVIDA, P.Q.
René Beaudet & Cie Ltée .... 122 High Street

TIMMINS, ONT.
Patricia Engineering Ltd. .... 168 Third Ave.

OTTAWA, ONT.
Darling Bros. Ltd. .... 18 Rideau Street

TORONTO, ONT.
Darling Bros. Ltd. .... 137 Wellington St. W.

WINNIPEG, MAN.
Darling Bros. Ltd. .... 123 Princess Street

CALGARY, ALTA.
H. F. Clarke & Co. Ltd. .... 1114 Fifth St. W.

VANCOUVER, B.C.
Frank Darling & Co. Ltd. .... 1144 Homer Street

ST. JOHN'S, NFLD.
Clayton Construction Co. Ltd. .... 198 Water Street

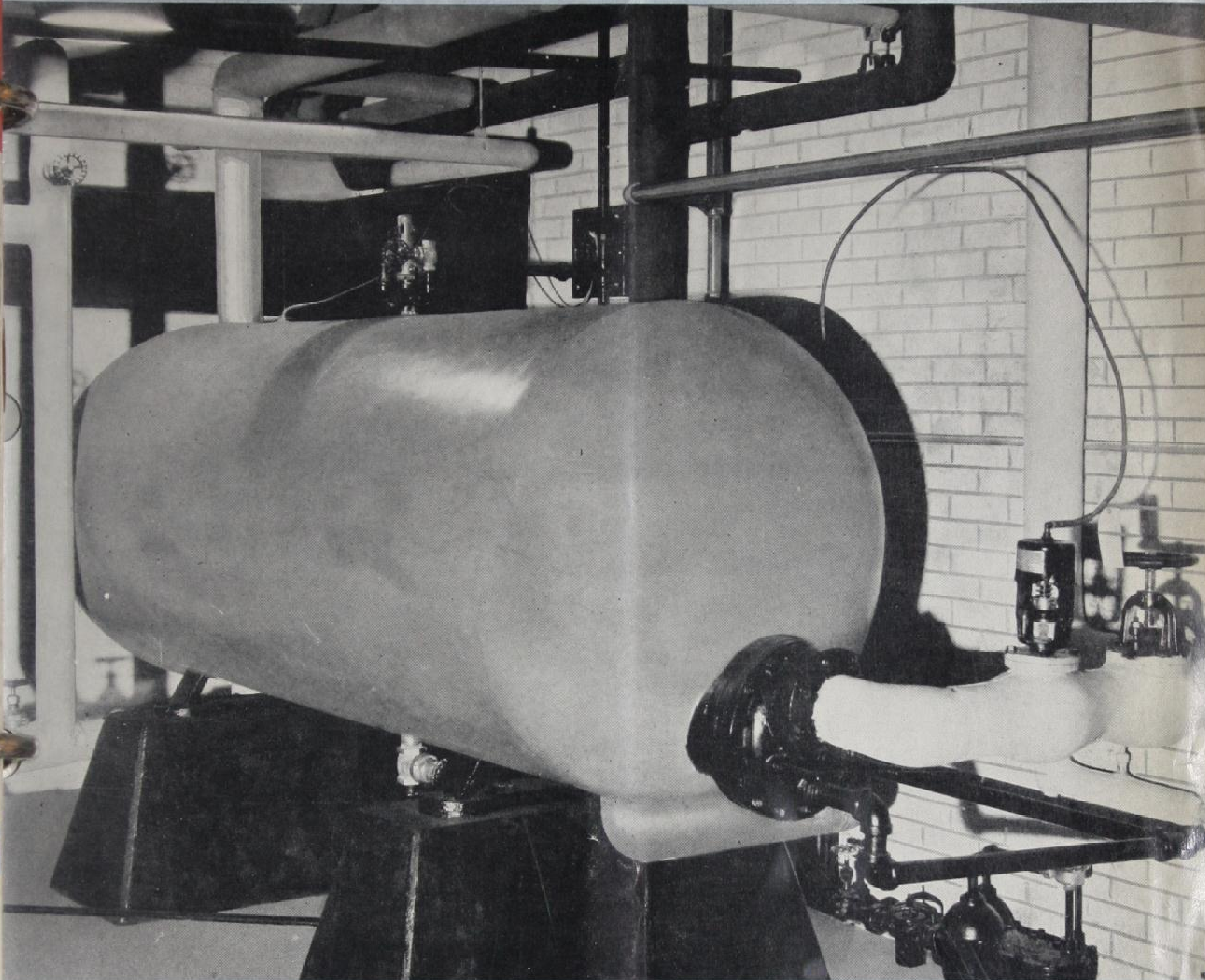
HEAD OFFICE AND WORKS

DARLING BROTHERS LIMITED

140 PRINCE ST. MONTREAL, CANADA

SINCE 1888

BULLETIN No. 40 M



WHITLOCK-DARLING

Type "K" **MONEL** STORAGE HEATERS

DARLING BROTHERS LIMITED

140 PRINCE STREET MONTREAL, CANADA

IFAX • SAINT JOHN, N.B. • QUEBEC • OTTAWA • TORONTO • TIMMINS • WINNIPEG • CALGARY • VANCOUVER • ST. JOHN'S, NFLD.

WHITLOCK-DARLING
Type "K" MONEL
STORAGE HEATERS

CONSTRUCTION AND INSTALLATION DETAILS

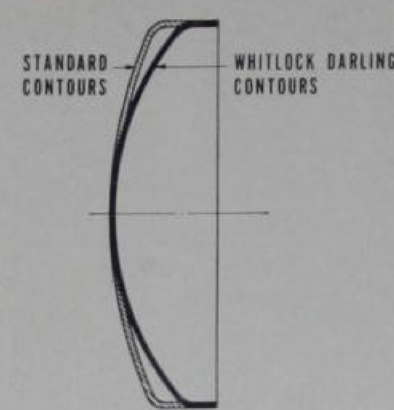


FIG. 1—Comparative Head Contours

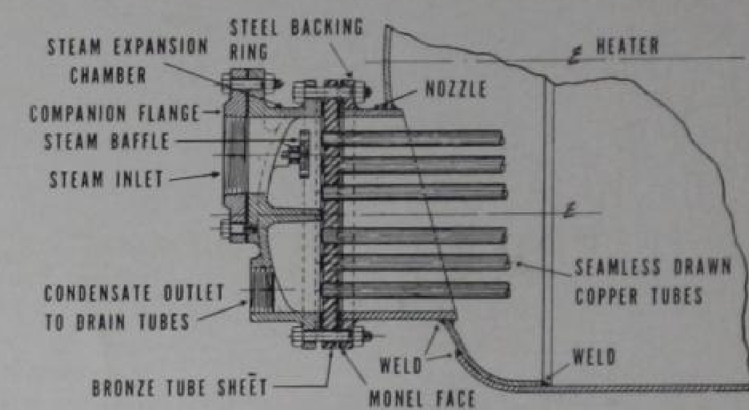


FIG. 2—Detail of Welded Head Port

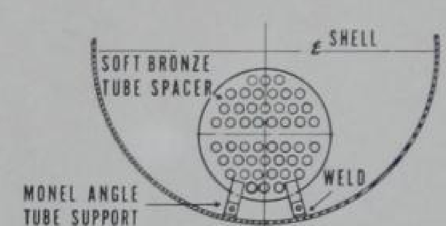


FIG. 3—Tube Support and Spacer

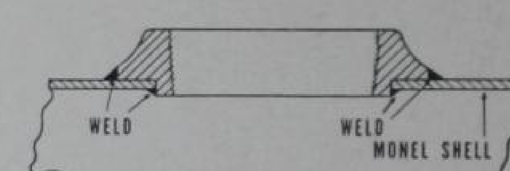


FIG. 4—Detail of Monel Connection to Heater Shell

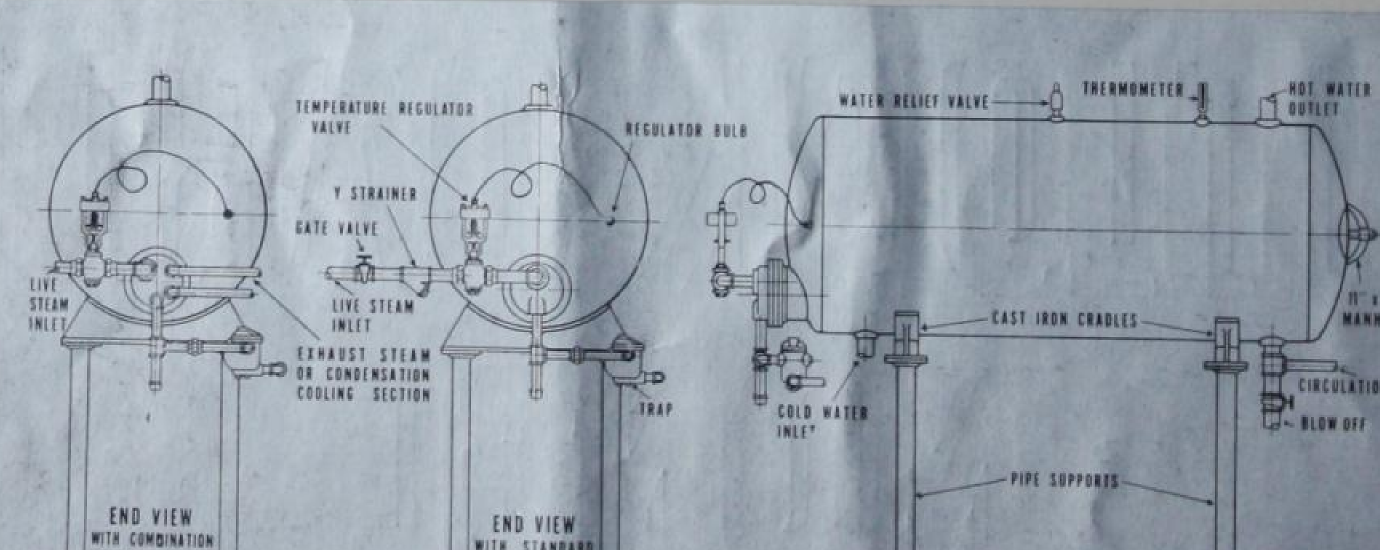


FIG. 5—Whitlock-Darling Type "K" Monel Heaters—Typical Installation Layouts

5M - MAY 1941

GENERAL DESCRIPTION

Storage Heaters are used for any service requiring large quantities of hot water at irregular intervals. As illustrations on back cover show, Type "K" Monel Heaters are installed in Hospitals, Office Buildings, Laundries, Hotels, Apartment Houses, Schools, Textile Mills and General Industrial Plants.

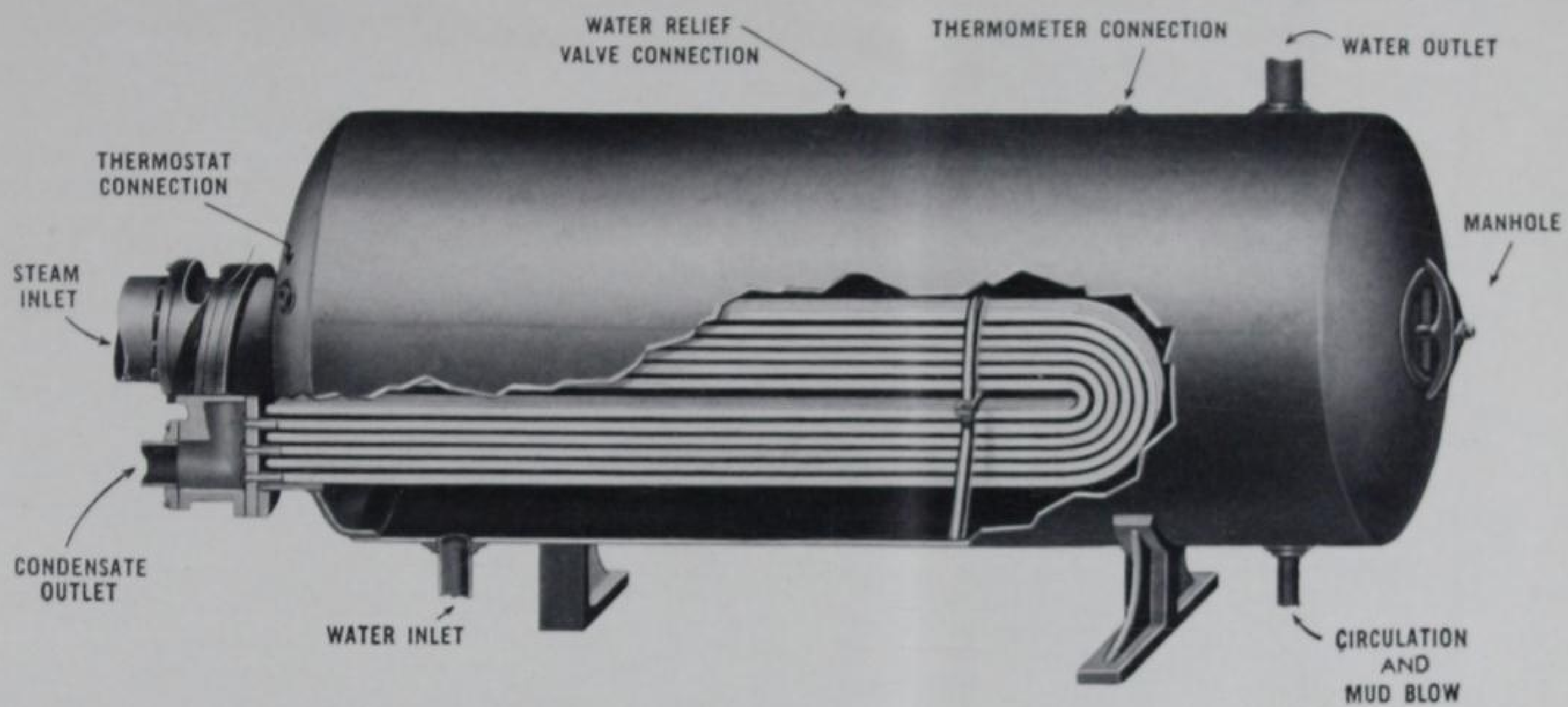


Fig. 6 Type "K" Monel Storage Heater—Horizontal Design

ADVANTAGES OF TYPE "K" STORAGE HEATERS

Whitlock Type "K" Monel Storage Heaters have proved so successful in supplying hot water for many kinds of services that they have won the approval of owners, architects, engineers, and contractors all over the country.

These heaters are of the steam actuated type and consist of a Monel storage shell in which is installed a removable, copper tube, heating section. Using steam at a fairly uniform rate, these heaters produce rust free hot water continually and recover after heavy drafts so that an ample supply is always available for the next "peak load" condition.

If there is a supply of exhaust steam available, this can be used to good advantage in the storage heater, as this heat can be stored in the form of hot water when otherwise it would be wasted. If high or low pressure steam direct from the boiler is used, the storage principle greatly helps the boiler efficiency by making the steam load more uniform.

AVAILABLE TYPES OF STORAGE HEATERS

Horizontal—Type "K" Monel Storage Heaters are installed usually in a horizontal position, as illustrated in Fig. 6 with the tube bundle located low in the shell where it is most effective and supported, if required, by a brass plate.

Vertical—Occasionally space requirements make it more convenient to install a storage heater vertically in which case the vertical design shown in Fig. 7 is used. These heaters are supported on structural steel legs.

Combination—This design, Fig. 5, is provided with a heating section having two separate units—one to use exhaust steam, condensate, or other primary supply of heat, and the other to use live steam under thermostatic control to "make up" the total amount required. These two units are entirely separated, each having its own supply and drip connections.

Submerged—Heaters of this type are connected just below the water line of the steam boiler so that the actual heating is done by hot water instead of steam.

ADVANTAGES OF MONEL CONSTRUCTION

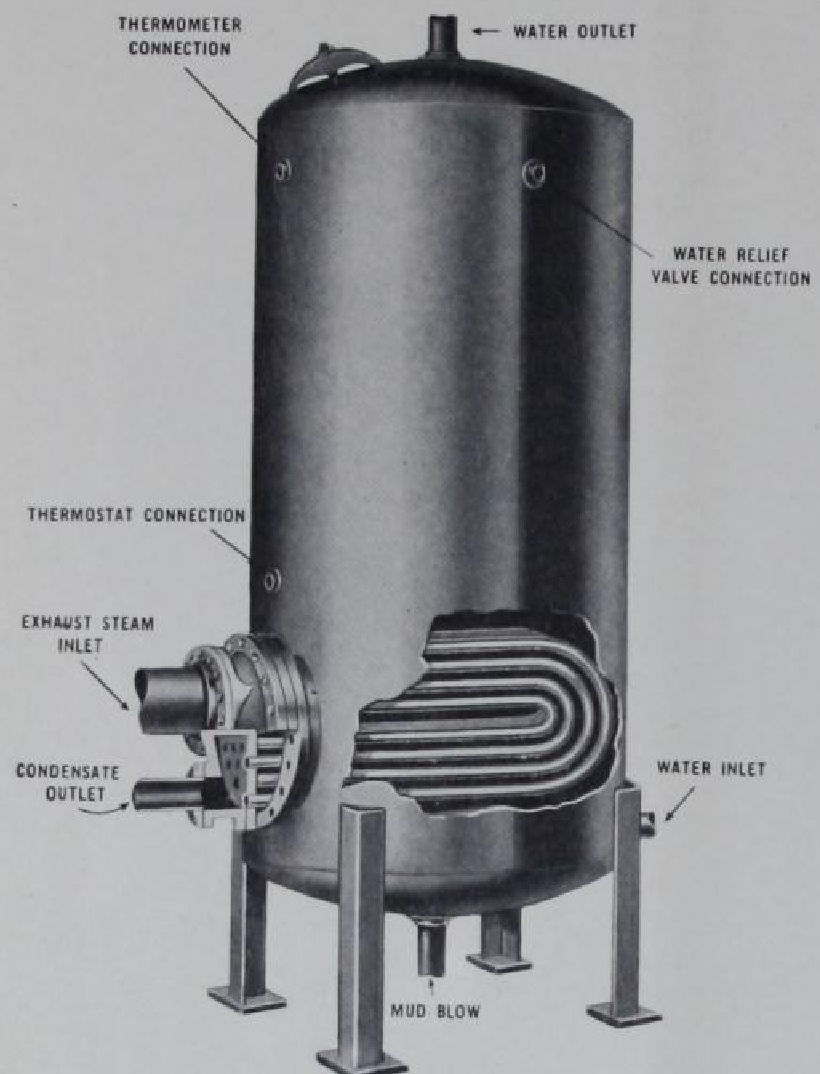


Fig. 7 Type 'K" Monel Storage Heater—Vertical Design

IMPORTANCE OF PROPER SHELL MATERIAL

Economically and technically it is sound to select a storage heater which is "good for the life of the building" in which it is to be installed. This fact becomes obvious when you consider that the size of the usual heater and the cramped basement quarters in which it is installed frequently makes replacement all but impossible, and it is always expensive.

In addition, since a heater is installed to provide an ever available supply of clean hot water, any interruption in this service causes trouble, ranging from simple inconvenience to a complete plant shutdown.

The selection of the proper material depends almost entirely upon the local water conditions. Some water supplies have little corrosive properties while others contain ingredients which render them highly corrosive—and always more actively so when the water is heated. Under some conditions, steel shells may have to be replaced within a few years and "red" water troubles may begin almost immediately upon installation.

Monel,* a native Canadian alloy of ⅔ Nickle and ⅓ Copper, is a solid non-ferrous metal. Monel with its silvery, smooth surface, its absolute immunity to rust and its high resistance to corrosion, insures a supply of clean rustless hot water at all times. Solid Monel has no coating to wear off. Its high strength and corrosion resistance contribute to the elimination of needless dead weight necessary when designed in other materials.

Monel is welded readily. The weld being of high efficiency, its strength is close to that of the parent metal. Rivets are done away with and the Monel shell gains all the advantages of one piece construction. This welded construction, coupled with the high strength and corrosion resistance of Monel, contribute to a design which enables Monel tanks to be manufactured and sold at prices offering real economy.

Repairs, maintenance and costly replacements are reduced to a minimum. Uninterrupted rustless hot water service is assured.

* "Monel" is a registered trade mark of The International Nickel Company of Canada Limited

20 YEAR GUARANTEE

On all Whitlock-Darling Monel Storage Heater installations the owner is provided with a certificate reading as follows:—

"If the Monel Hot Water Storage Tank sold hereunder, leaks, fails or breaks down as a result of rust, corrosion or other chemical action of the domestic water supply, at any time within TWENTY YEARS from the date of installation, we guarantee to supply the owner a new Monel Hot Water Storage Tank in exchange for the original, without charge, provided that the tank shall have been in use to serve only the hot water requirements of the owner.

We shall have no liability for damages to person or property or for any labor cost. Our only obligation by virtue of this guarantee shall be to supply a new tank without charge, as stated above."

SELECTING PROPER SIZE HEATER

TABLE "A" - HOT WATER FIXTURE CAPACITIES FOR VARIOUS TYPES OF BUILDINGS

U.S. gallons of water per hour per fixture figured at a final temperature of 180° Fahrenheit

	Apartment House	Club	Gymnasium	Hospital	Hotel	Industrial Plant	Office Building	Public Bath	Private Residence	School	Y.M.C.A.
Basins, Private Lavatory..	2	2	2	2	2	2	2	2	2	2	2
Basins, Public Lavatory...	4	6	8	6	8	12	6	12	..	15	8
Bath Tubs..............	20	20	30	20	20	30	..	45	20	..	30
Dish Washers............	15	50-150	..	50-150	50-200	20-100	..	..	15	20-100	20-100
Foot Basins.............	3	3	12	3	3	12	..	..	3	3	12
Kitchen Sink............	10	20	..	20	20	20	..	..	10	10	20
Laundry, Stationary Tubs	20	28	..	28	28	..	..	..	20	..	28
Pantry Sink.............	5	10	..	10	10	..	..	..	5	10	10
Showers.................	75	150	225	75	75	225	..	225	75	225	225
Slop Sink...............	20	20	..	20	30	20	15	15	15	20	20
Hourly Heating Capacity Factor............	30%	30%	40%	25%	25%	40%	30%	50%	30%	40%	40%
Storage Capacity Factor...	125%	90%	100%	60%	80%	100%	200%	120%	70%	100%	100%

The size of Whitlock-Darling Type "K" Monel Storage Heater required for a certain building can be found from this table as follows:

Hourly heating capacity = Hourly requirements from table × Hourly heating capacity factor.

Storage capacity = Hourly heating capacity × Storage capacity factor.

Reference to table C on page 7 will show correct size of shell and heating section at once.

To illustrate the above method of selecting the proper heater, we will take the hot water requirements of a small hotel.

Private lavatories........	100 @	2 gals. each	200 gals. per hr.
Public lavatories.........	10 @	8 gals. each	80 gals. per hr.
Bathtubs..................	75 @	20 gals. each	1500 gals. per hr.
Dishwashers...............	2 @	30 gals. each	60 gals. per hr.
Kitchen sinks.............	3 @	20 gals. each	60 gals. per hr.
Pantry sinks..............	3 @	10 gals. each	30 gals. per hr.
Showers...................	24 @	75 gals. each	1800 gals. per hr.
Slop sinks................	9 @	30 gals. each	270 gals. per hr.

Maximum hourly requirements (total)......4000 gals. per hr.

Hourly heating capacity equals 4000 multiplied by 25% or 1000 gal. per hour.

Storage capacity equals 1000 multiplied by 80% or 800 gal.

Nearest shell size to 800 gal. is No. 22 (42 x 144 in.). Heating section of 1000 gal. capacity is No. H13. Heater required is then Whitlock-Darling Type "K" No. 22H13.

WHITLOCK-DARLING
Type "K"
STORAGE HEATERS

TYPICAL SPECIFICATION

A complete specification includes paragraphs A to G inclusive. Note the OPTIONAL PARAGRAPH at the end covering double heating sections.

A—GENERAL

Furnish and install in horizontal position as shown on plans one Whitlock-Darling type K monel metal storage heater, as manufactured by Darling Brothers Limited, Montreal.

B—STORAGE CAPACITY

The heater shall have a storage capacity of .... U.S. gallons. The shell shall be........ inches in diameter by.........inches long. Shell thickness........head thickness ....inches, suitably welded to withstand a working pressure of..........lbs. (Select shell and head thickness from table B.)

C—HEATING CAPACITY

The heater shall be fitted with a heating section, capable of heating.........U.S. gallons of water per hour from 40° to 180°F. when supplied with sufficient steam at..........lbs. gauge pressure.

D—SHELL CONSTRUCTION

The shell shall be constructed of cold rolled Monel boiler plate with welded seams properly designed for the specified working pressure, necessary connections, of sizes recommended by the heater manufacturer for specified duty, and an 11" x 15" manhole in rear head shall be provided. All parts in contact with water shall be of non-ferrous material.

E—HEATING SECTION

The heating section shall consist of seamless drawn copper tubing made up into U-bends with ends expanded into a bronze tube sheet. The heating section shall be properly supported in the shell of the heater, shall be easily accessible and arranged so that the entire heating section can be easily removed from the shell for cleaning or inspection.

F—DISTRIBUTING HEAD

The steam distributing head, baffle at inlet and supporting cradles (if horizontal heater) shall be of cast iron.

G—TEST

Before shipment, shell and heating section shall be submitted to a hydrostatic test pressure as required by the laws of the Province in which it is to be installed, with a minimum test pressure of 50% in excess of the working pressure.

OPTIONAL PARAGRAPH

C-1—IF DOUBLE HEATING SECTION IS WANTED

The heating section shall be capable of heating ........U.S. gallons of water an hour from 40°F. to 180°F. when the primary heating section is supplied with..........lbs. of exhaust steam of condensate at......°F. and the auxiliary heating section is supplied with live steam at.........lbs. gauge pressure, under control of a temperature regulating valve of approved design.

TABLE "B" - MONEL SHELL AND HEAD THICKNESSES FOR TYPE "K" HEATERS

To meet the requirements of the Departments of Labor, Boiler Inspection Branch, Provinces of Ontario and Quebec.

Shell Diameter Inches	200 lbs. Test Pressure 85 lbs. Working Pressure		250 lbs. Test Pressure 106 lbs. Working Pressure		300 lbs. Test Pressure 127 lbs. Working Pressure	
	Shell	Head	Shell	Head	Shell	Head
18	.048	.070	.052	.087	.057	.104
24	.063	.109	.075	.124	.088	.139
30	.079	.116	.100	.140	.119	.174
36	.095	.140	.120	.174	.143	.208
42	.111	.163	.140	.203	.167	.243
48	.127	.186	.160	.232	.191	.278
54	.143	.209	.179	.260	.214	.312
60	.160	.232	.199	.290	.238	.347
66	.176	.255	.219	.318	.262	.382
72	.192	.278	.239	.347	.286	.416

CAPACITIES AND DIMENSIONS - HORIZONTAL TYPE "K" HEATERS

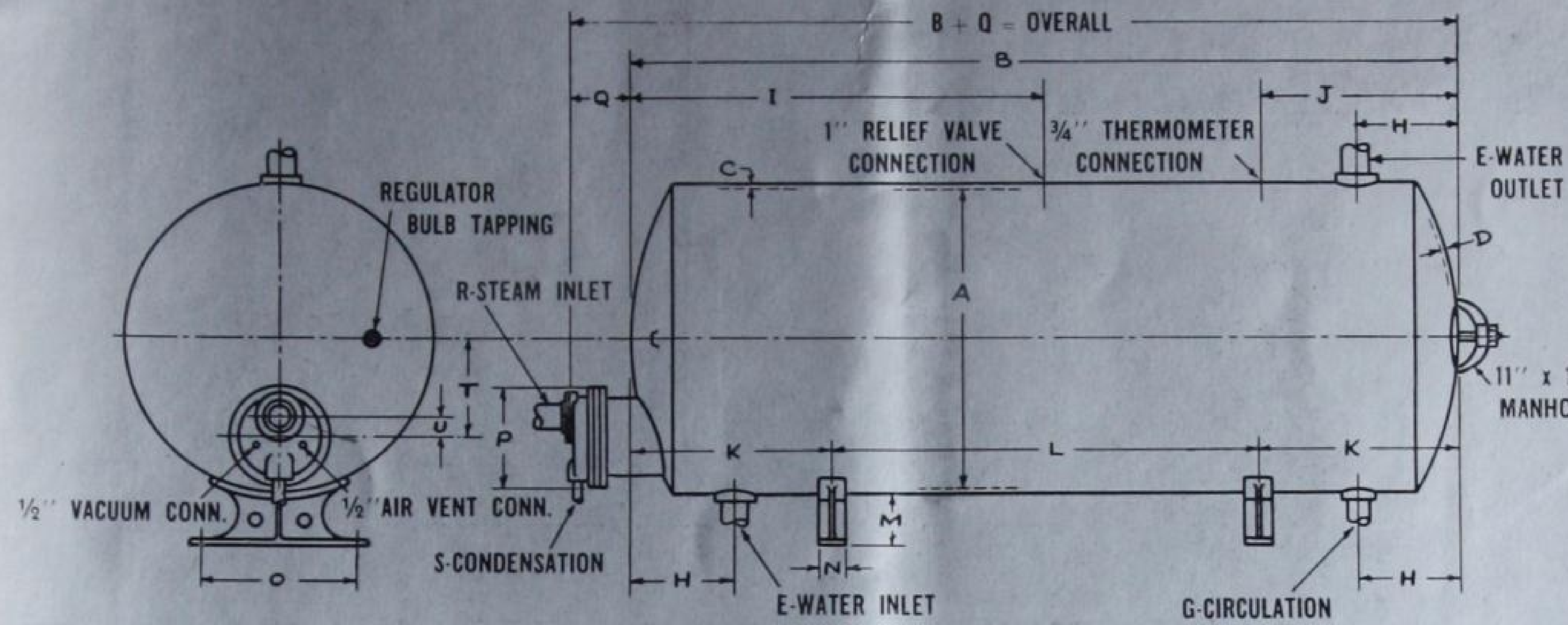


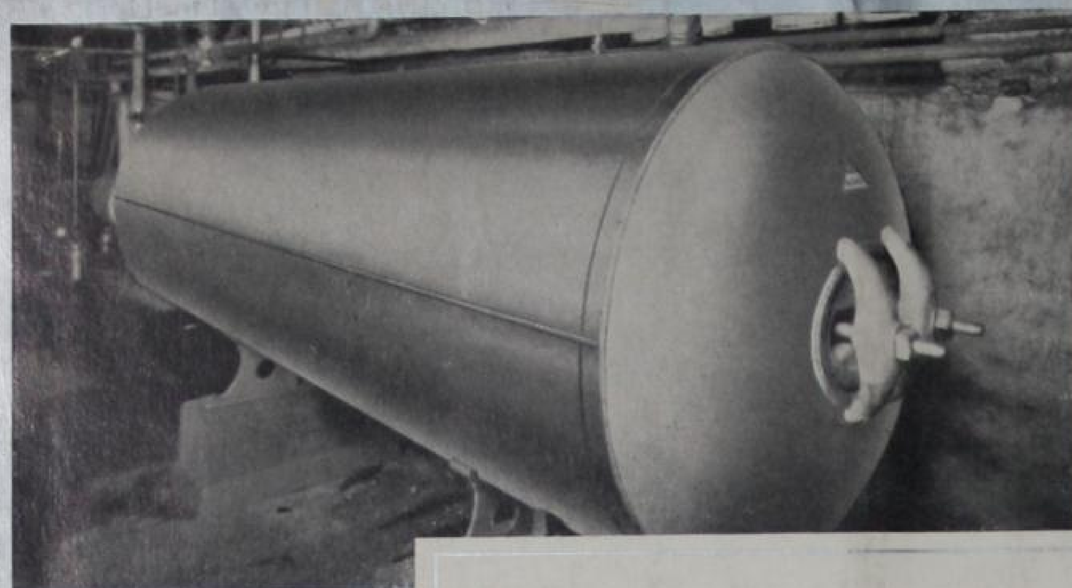
TABLE "C"—WHITLOCK-DARLING TYPE "K" MONEL STORAGE HEATERS (HORIZONTAL)

SHELLS												Standard cradles			Pipe leg cradles			HEATING SECTIONS									
Number	Gallons — One Filling	A—Diam. Shell	B—Length, in., add Q—for over all	Approx. wt. lbs. see note below	C—Thickness of shell D—Thickness of head	E—Water inlet and outlet, in.	G—Circulation, in.	H—Location of water connection, in.	J—Location of thermometer in.	K—Location of cradles, in.	L—c. c. of cradles	M—Height, in.	N—Width, in.	O—c.c. of bolt holes, in.	M—Height, in.	N—Diam. of pipe legs, in.	O—c. c. of, pipe legs, in.	Number	Gallons per hour*	Smallest shell into which section will fit, in.	Weight of entire section—lbs.	P—Diam. of head port, in.	Q—Add to B for over all, in.	R—Max. and std. steam inlet, in.	S—Max. and std. condensation	T—Center heater to center of section	U—Location of steam inlet in.
1	60	18	60	215	See Table B page 6—thicknesses depend upon the Working Pressures	2	2	10	22	18	24	4	2½	11	2	1½	15	H0	100	18x60	75	9¼	6¼	2	1		1⅞
2	75	18	72	240		2	2	10	22	18	36	4	2½	11	2	1½	15	H1	150	18x60	80	9¼	6¼	2	1		1⅞
3	85	18	84	255		2	2	10	22	18	46	4	2½	11	2	1½	15	H2	200	18x72	90	9¼	6¼	2	1		1⅞
4	110	24	60	360		2	2	11	23	19	22	6	3	14	2½	2	17	H3	250	18x60	175	12¼	7½	3½	2		2¾
5	130	24	72	390		2	2	11	23	19	34	6	3	14	2½	2	17	H4	300	18x60	185	12¼	7½	3½	2		2¾
6	150	24	84	410		2	2	11	23	19	46	6	3	14	2½	2	17	H5	350	18x60	190	12¼	7½	3½	2	½ "A"—½ "P" or ½ Diam. Shell Minus ½ Diam. Head Port.	2¾
7	170	24	96	440		2	2	11	23	19	56	6	3	14	2½	2	17	H6	400	18x60	200	12¼	7½	3½	2		2¾
8	170	30	60	490		3	2	12	24	20	20	7	3	19	3	2	22	H7	500	18x72	210	12¼	7½	3½	2		2¾
9	200	30	72	520		3	2	12	24	20	32	7	3	19	3	2	22	H8	550	18x72	215	12¼	7½	3½	2		2¾
10	240	30	84	550		3	2	12	24	20	44	7	3	19	3	2	22	H9	600	18x84	220	12¼	7½	3½	2		2¾
11	280	30	96	580		3	2	12	24	20	56	7	3	19	3	2	22	H10	700	24x60	300	15¼	7½	5	2		2¾
12	320	30	108	600		3	2	12	24	20	64	7	3	19	3	2	22	H11	800	24x96	260	12¼	7½	3½	2		2¾
13	300	36	72	700		3	2	14	26	22	32	8	3	21½	3½	2½	25½	H12	900	30x108	270	12¼	7½	3½	2		2¾
14	340	36	84	740		3	2	14	26	22	40	8	3	21½	3½	2½	25½	H13	1000	36x120	285	12¼	7½	3½	2		2¾
15	400	36	96	780		3	2	14	26	22	52	8	3	21½	3½	2½	25½	H14	1250	24x84	370	15¼	7½	5	2		2¾
16	450	36	108	820		3	2	14	26	22	64	8	3	21½	3½	2½	25½	H15	1500	30x108	425	15¼	7½	5	2		2¾
17	500	36	120	860		3	2	14	26	22	76	8	3	21½	3½	2½	25½	H16	1750	36x120	450	15¼	7½	5	2		2¾
18	460	42	84	960		4	2	17	29	26	40	8	3½	25½	3⅞	3	26	H17	2000	30x96	570	18¼	8½	6	2½		3¼
19	530	42	96	1030		4	2	17	29	26	44	8	3½	25½	3⅞	3	26	H18	2400	36x120	620	18¼	8½	6	2½		3¼
20	610	42	108	1100		4	2	17	29	26	64	8	3½	25½	3⅞	3	26	H18A	2500	36x120	630	18¼	8½	6	2½		3¼
21	680	42	120	1180		4	2	17	29	26	68	8	3½	25½	3⅞	3	26	H19	2800	42x144	670	18¼	8½	6	2½		3¼
22	800	42	144	1320		4	2	17	29	26	92	8	3½	25½	3⅞	3	26	H19A	3000	42x144	695	18¼	8½	6	2½		3¼
23	970	42	168	1510		4	2	17	29	26	116	8	3½	25½	3⅞	3	26	H20	3200	36x96	860	21¼	9⅜	8	2½		4⅝
24	700	48	96	1360		4	2	18	30	27	44	9	4	29	4	3	24½	H20A	3500	36x108	905	21¼	9⅜	8	2½		4⅝
25	790	48	108	1460		4	2	18	30	27	60	9	4	29	4	3	24½	H21	3600	36x108	920	21¼	9⅜	8	2½		4⅝
26	870	48	120	1560		4	2	18	30	27	66	9	4	29	4	3	24½	H22	4000	36x120	950	21¼	9⅜	8	2½		4⅝
27	1050	48	144	1760		4	2	18	30	27	90	9	4	29	4	3	24½	H23	4400	42x144	1020	21¼	9⅜	8	2½		4⅝
28	1250	48	168	1920		4	2	18	30	27	114	9	4	29	4	3	24½	H23A	4500	42x144	1040	21¼	9⅜	8	2½		4⅝
29	1300	48	180	2190		4	2	18	30	27	138	9	4	29	4	3	24½	H24	4800	36x96	1200	24¼	9⅝	10	3		5⅝
30	1000	54	108	1760		4	2	20	32	30	60	9	4½	33	4½	4	27	H24A	5000	36x96	1235	24¼	9⅝	10	3		5⅝
31	1100	54	120	1880		4	2	20	32	30	60	9	4½	33	4½	4	27	H25	5400	36x108	1300	24¼	9⅝	10	3		5⅝
32	1300	54	144	2120		4	2	20	32	30	84	9	4½	33	4½	4	27	H26	6000	36x120	1380	24¼	9⅝	10	3		5⅝
33	1500	54	168	2370		4	2	20	32	30	108	9	4½	33	4½	4	27	H27	7000	42x96	1950	30¼	11⅞	12	4		6½
34	1800	54	192	2660		4	2	20	32	30	132	9	4½	33	4½	4	27	H28	8000	42x96	2000	30¼	11⅞	12	4		6½
35	1300	60	120	2320		4	2	20	32	30	60	10	5	37	4½	4	31	H29	9000	42x108	2300	30¼	11⅞	12	4		6½
36	1600	60	144	2620		4	2	20	32	30	84	10	5	37	4½	4	31	H30	10000	42x120	2460	30¼	11⅞	12	4		6½
37	1900	60	168	2910		4	2	20	32	30	108	10	5	37	4½	4	31										
38	2200	60	192	3210		4	2	20	32	30	132	10	5	37	4½	4	31										
39	1950	66	144	3150		4	2	22	34	32	80	10	6	39	6	4	35										
40	2300	66	168	3500		4	2	22	34	32	104	10	6	39	6	4	35										
41	2650	66	192	3860		4	2	22	34	32	128	10	6	39	6	4	35										
42	2300	72	144	3670		4	2½	23	35	34	76	8	6½	41½	8	4	39										
43	2700	72	168	4040		4	2½	23	35	34	100	8	6½	41½	8	4	39										
44	3100	72	192	4520		4	2½	23	35	34	120	8	6½	41½	8	4	39										
45	3400	72	216	4940		4	2½	23	35	34	130	8	6½	41½	8	4	39										

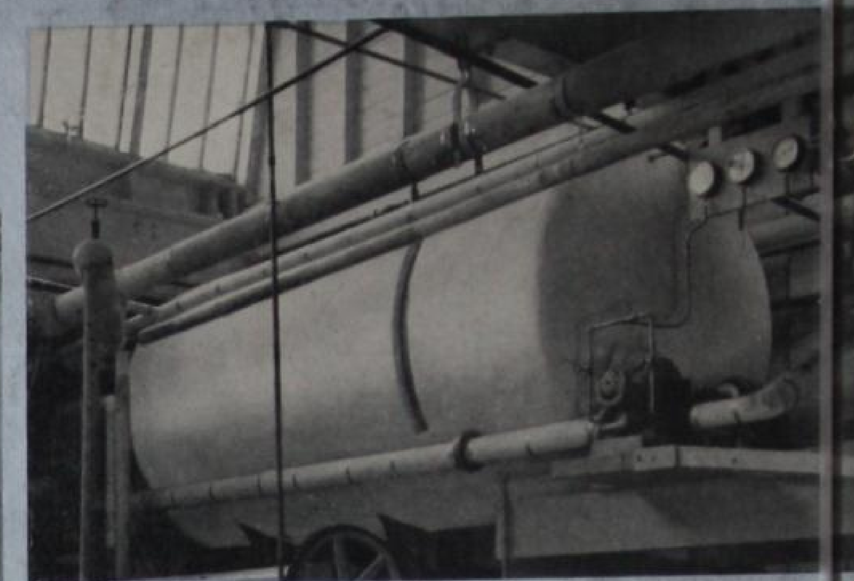
*"The generally accepted manner of expressing the heating capacity of a hot water service heater, is in U.S. gallons of water per hour, heated from 40° to 180°F. when supplied with steam at atmospheric pressure. All the heating sections given in the above table are rated in this manner.
In actual practice the final temperature of the water required and the steam pressure available, quite often vary from the standard conditions given above—with higher steam pressures and/or lower final water temperatures, the heating sections become smaller."

Weights shown are for 106 lbs. W.P.—add 15% for 127 lbs. W.P.—deduct 10% for 85 lbs. W.P.

IN LAUNDRIES



PARISIAN SANITARY LAUNDRY
HAMILTON, ONTARIO



KENWOOD MILLS, ARNPRIOR, ONTARIO

IN INDUSTRIAL PLANTS

WHITLOCK-DARLING Type "K" MONEL

Storage Heaters are used for any service requiring large quantities of **rust-free** hot water at irregular intervals. The illustrations shown are representative of Whitlock-Darling Monel Heater installations in

HOSPITALS	SCHOOLS AND COLLEGES
LAUNDRIES	OFFICE BUILDINGS
APARTMENTS	HOTELS
CLUBS	PUBLIC BUILDINGS

TEXTILE AND OTHER INDUSTRIAL PLANTS

For quotations or further information, write

DARLING BROTHERS LIMITED
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IN HOSPITALS

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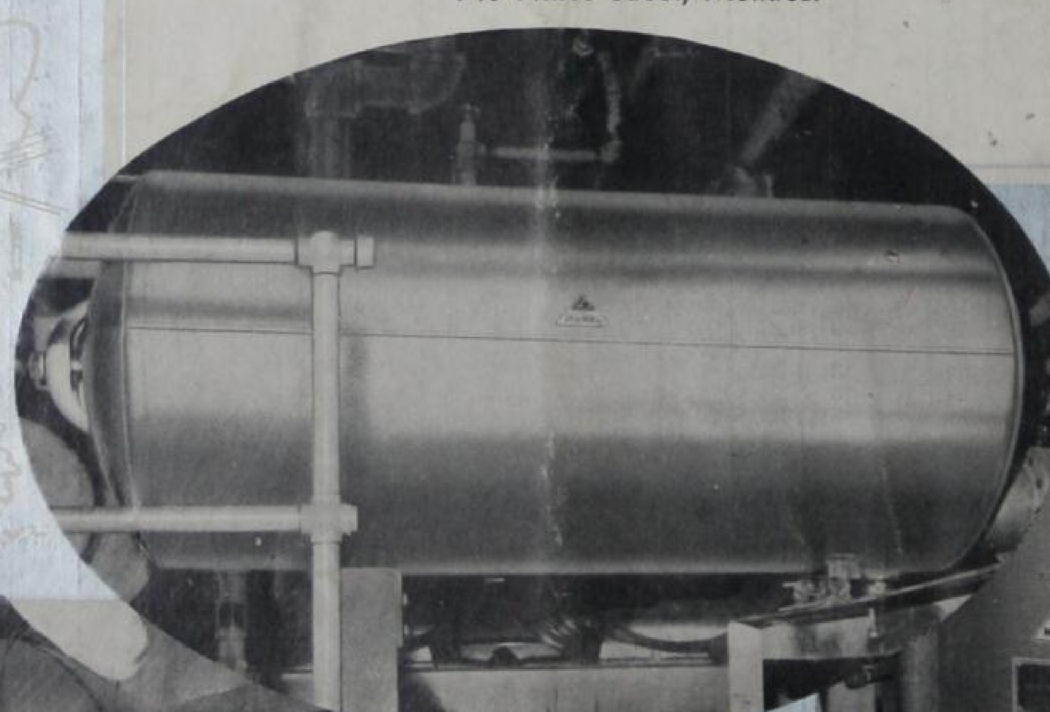
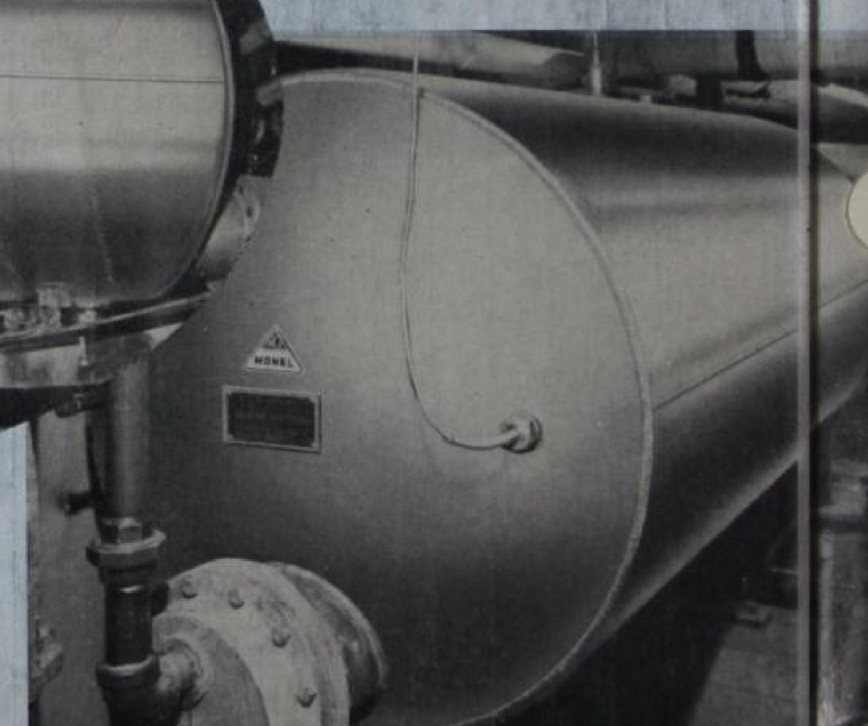
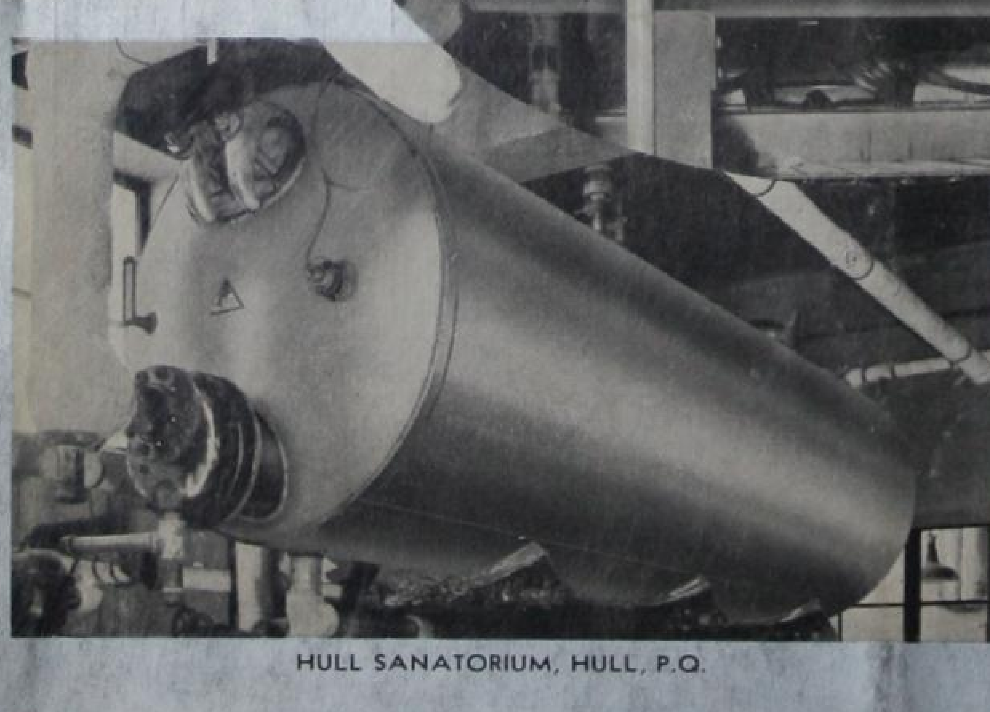


BANK OF COMMERCE
TORONTO, ONTARIO



POST OFFICE TERMINAL BUILDING, TORONTO, ONTARIO



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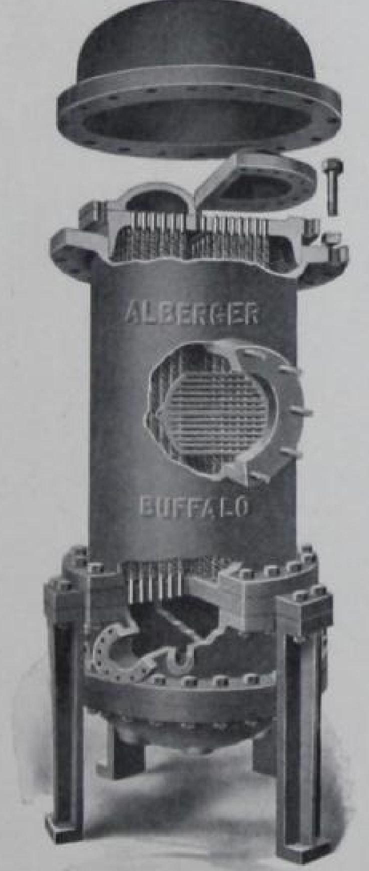
29-d-2

FEED WATER HEATERS

Closed Type

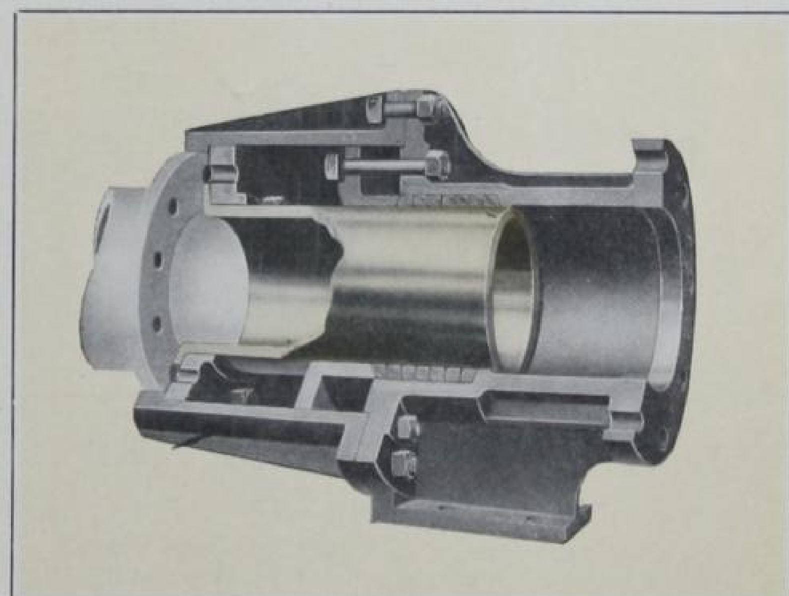


May be furnished in either vertical or horizontal type for any feed water service, either for the small boiler plant or for the more exacting requirements of the larger plants employing stage heating. These heaters are built for any operating pressure.

Howard Guided Expansion Joints

for Pipe Lines

Designed to perform a difficult service well



Outside and inside guided.
Liberal packing spaces.
Entirely enclosed and *Dirt Proof*.
Stuffing box adjustable from the outside.

Built for standard low pressure and high pressure service, for water or other liquids and steam, with or without superheat.

Write for our Expansion Joint Bulletin

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BUFFALO, N. Y.
(Associate Company)

Water Equipment Limited
Representatives
145 Wellington Street, West
Toronto, Canada

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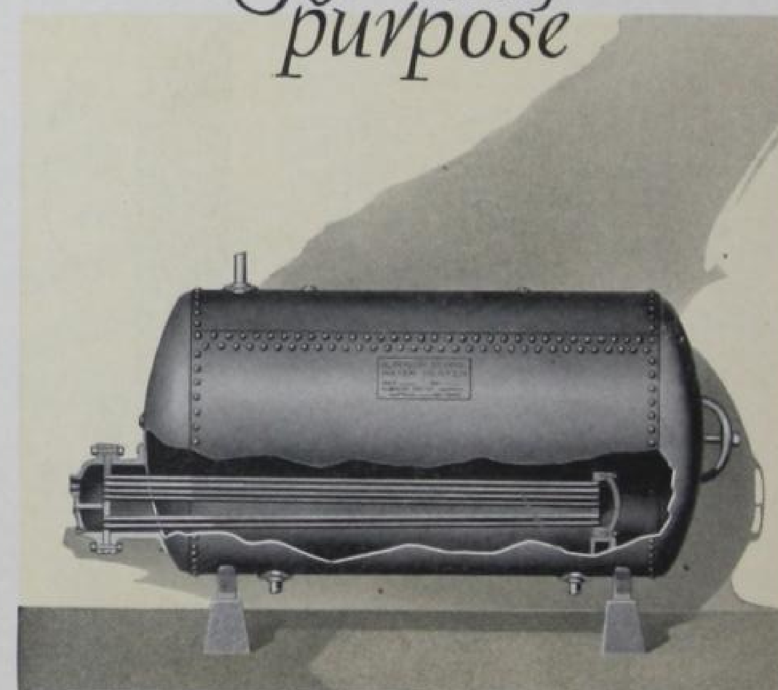
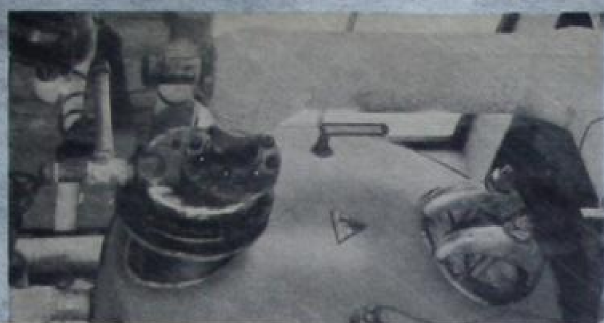
Hot Water *for any purpose*



STORAGE TYPE HEATER

THE heaters briefly described in this folder constitute but a portion of the Alberger line of Heaters, Coolers, Economizers, Vapor Condensers, and Heat Interchange Equipment. Further information furnished on request.

ALBERGER HEATER CO.
BUFFALO, N. Y.



IN HOSPITALS

PARISIAN SANITARYLAU
HAMILTON, ONTARI

SWIMMING POOL HEATERS

Three conditions distinguish the modern swimming pool—filtration, sterilization, *uniform temperature*. The Alberger Swimming Pool Heater was designed to economically maintain the pool at a uniform temperature, comfortable for the swimmer.

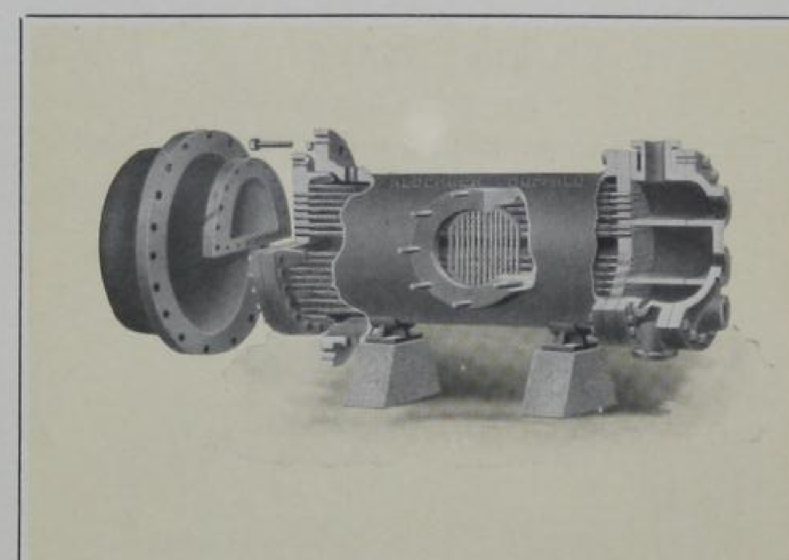
As the water is circulated, it passes from the filters to the heater, where it is brought to the desired pool temperature.

No hot or cold spots in the pool, every portion at practically the same temperature.

This heater requires little space and is furnished in either the vertical or horizontal type. The heating surface is copper, the other parts cast iron.

Alberger-Buffalo Heaters *for Salt Water Pools*

We furnish heaters designed for handling sea-water pools. The straight tube construction which we employ is especially desirable where the water carries sand, because there is not the possibility of wear from this source which occurs with bent tubes. These heaters give the utmost in service and satisfaction.



INSTANTANEOUS HEATERS

Floating Head Type

Compact—sturdy construction—built for convenience in operation. For large and small capacities, and for any desired operating conditions.

These Heaters Are Adapted for a Great Variety of Service, including

- Domestic water service in hotels, office buildings, hospitals, etc.
- Laundries.
- Hot Water Heating Systems.
- Industrial Processes.
- Feedwater Heaters.
- Extraction Heaters.
- Vapor Condensers.
- Heating or Cooling Oils.

FOR SMALL CAPACITIES

THE ALBERGER BUFFALO

Type "A"

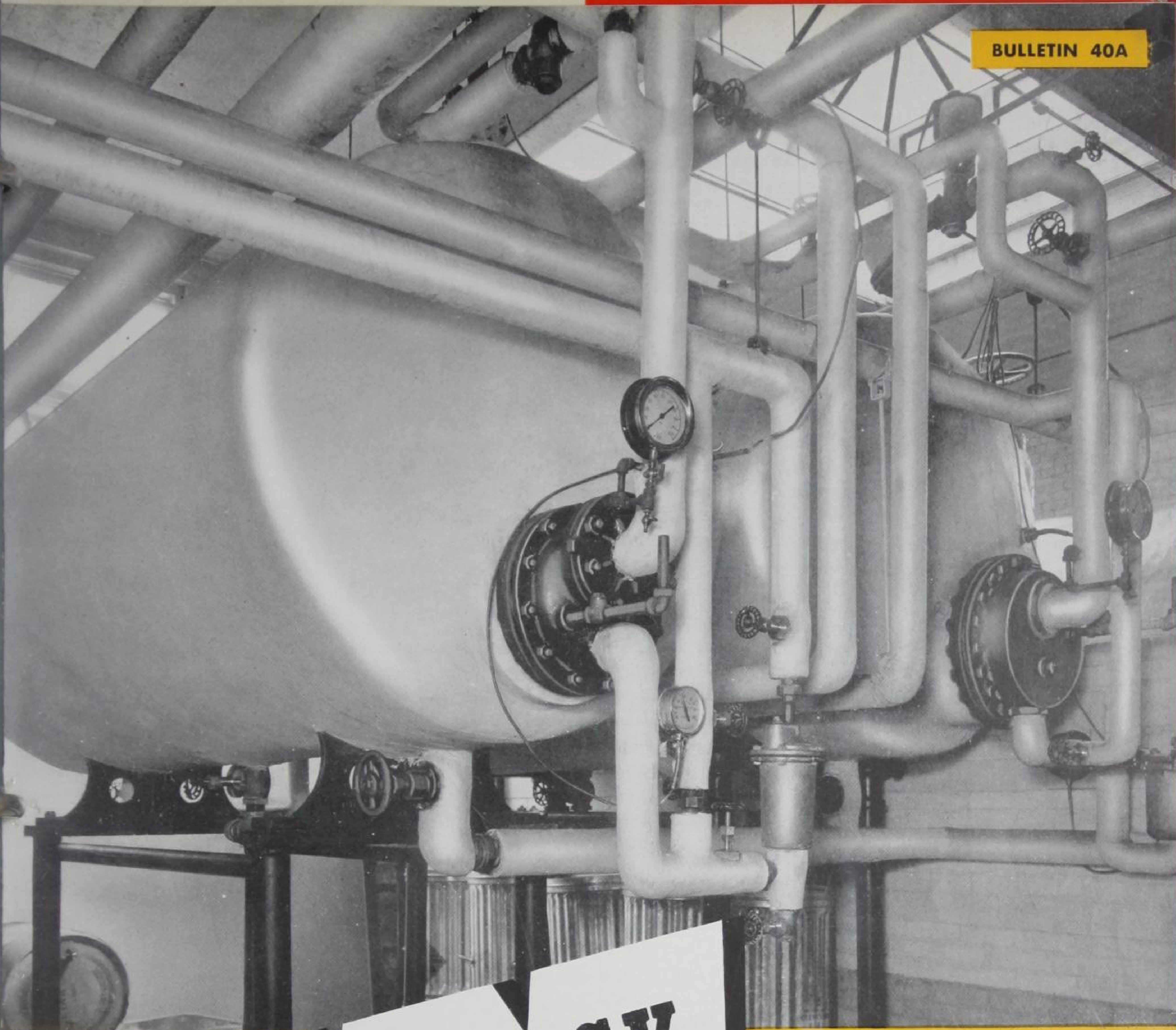
This heater is just the thing for the smaller hot water problems frequently encountered where only a few hundred gallons of water are needed per hour. Often used for mill and factory washrooms, public garages, and similar service.

Very compact, and can be mounted in either vertical or horizontal position.

Our Engineering Experience at Your Service

If you have a special problem involving the heating or cooling of water or other liquids, send us full details and our engineering department will be pleased to recommend the most efficient method of meeting the conditions. Requesting this information, of course, implies no obligation on your part.

BULLETIN 40A



WHITLOCK TYPE K STORAGE HEATERS

1953

FOR HOSPITALS • LAUNDRIES • TEXTILE MILLS • FINISHING PLANTS • HOTELS • APARTMENT HOUSES • SCHOOLS • COLLEGES • PROCESS AND GENERAL INDUSTRIAL PLANTS

THE WHITLOCK MANUFACTURING CO., HARTFORD 10, CONNECTICUT

Advantages OF WHITLOCK TYPE K STORAGE HEATERS

The Whitlock Type K Storage Heater needs no introduction to our many friends throughout the country. The advantages of the storage type of heater for varying hot water demand rates is well known. This bulletin has been written for the convenience of architects, engineers and purchasers to facilitate their selection of Whitlock Type K Storage Heaters for conditions normally found in buildings of various classifications.

Where the demand for hot water is intermittent, and/or where the steam or heating medium supply is intermittent, the storage heater is preferable to an instantaneous heater. For example, consider a typical case where the hot water demand rate at 180°F. is as follows during a one hour period:

First 40 minutes — No hot water drawn.
Last 20 minutes — 1000 gallons of hot water withdrawn.

Since the 1000 gallons was drawn in 20 minutes, the actual average flow rate is 50 G.P.M. or 3000 G.P.H. An instantaneous heater to handle this requirement would have to be designed to heat at the rate of 3000 G.P.H. and would require steam at the rate of 105 boiler H.P. The Whitlock Type K Storage Heater, with a storage capacity in excess of 1000 gallons, will heat this 1000 gallons over a period of one hour and will use steam at the rate of 35 boiler H.P.

A Whitlock Type K Storage Heater, properly sized for the requirements, will absorb heat from any available quantity of exhaust steam or condensate, even at non-uniform flow rates, and deliver hot water at the desired temperature, also at irregular demand rates. If the quantity of exhaust steam or hot condensate is insufficient to produce enough hot water, additional live steam may be supplied through a separate heating element provided for this purpose when required.

CLASSES OF CONSTRUCTION

The Whitlock Type K Storage Heater is flexible in design to facilitate its selection for individual requirements.

HORIZONTAL HEATERS

This is the preferred position and the heater is furnished and equipped accordingly unless otherwise specified. The heating element is installed close to the bottom of the shell to take maximum advantage of hot water storage. Bronze tube supports are furnished when the length of tube bundle indicates their use, and these, in turn, are secured to the shell. The entire bundle is removable for inspection. Heaters are furnished with supporting cradles drilled for anchor bolts.

VERTICAL HEATERS

When space is limited, this may be the preferred method of installation, and when so ordered will be furnished and equipped accordingly. Vertical heaters are supported by three removable pipe legs complete with floor flanges or when indicated by purchaser the heater may be supported from the floor by means of structural steel supports. Unless otherwise specified, the distance from bottom of heater to floor level will be 12″.

COMBINATION HEATERS

When heat is supplied from several sources, it is desirable to use a separate heating element for each source of supply. For example, if a part of the heating is to be done with exhaust steam and the balance with live steam, the exhaust steam heating element should be located low in the shell to get the maximum use from the exhaust steam. A separate heating element for live steam should be used and installed above the exhaust steam element, either in the same end or at the opposite end. Likewise, if part of the heating is to be done with hot condensate, or condensate flash from a receiver, the heating element should be located low in the shell, or, if more convenient, in a separate shell entirely. While the accompanying photograph indicates two separate heating elements—one for the primary heat source and the other for the live steam—the combination heater can be furnished with a single heating element, properly partitioned, to accept both heating sources — each at a different pressure. The combination heater can be furnished for vertical or horizontal installation.

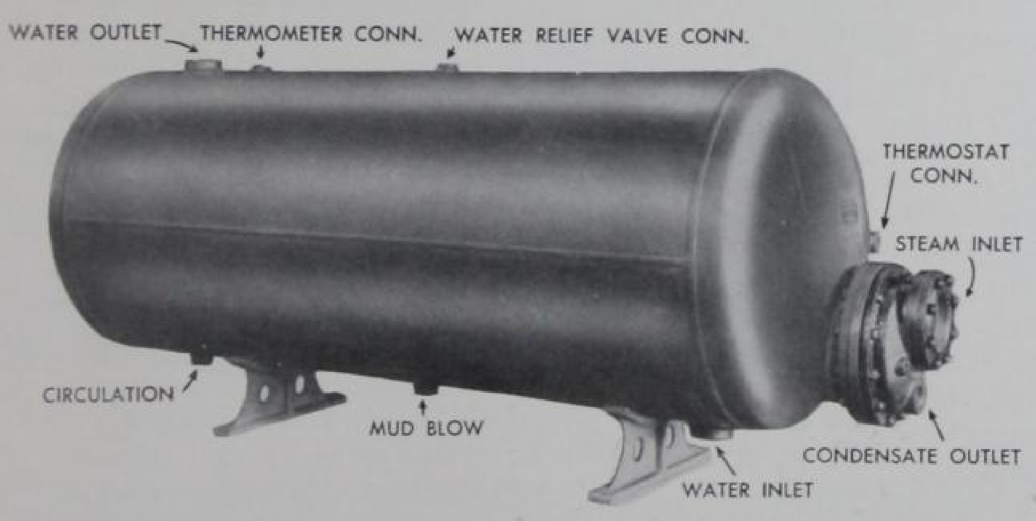


Fig. 1. Type K Storage Heater, Horizontal Design

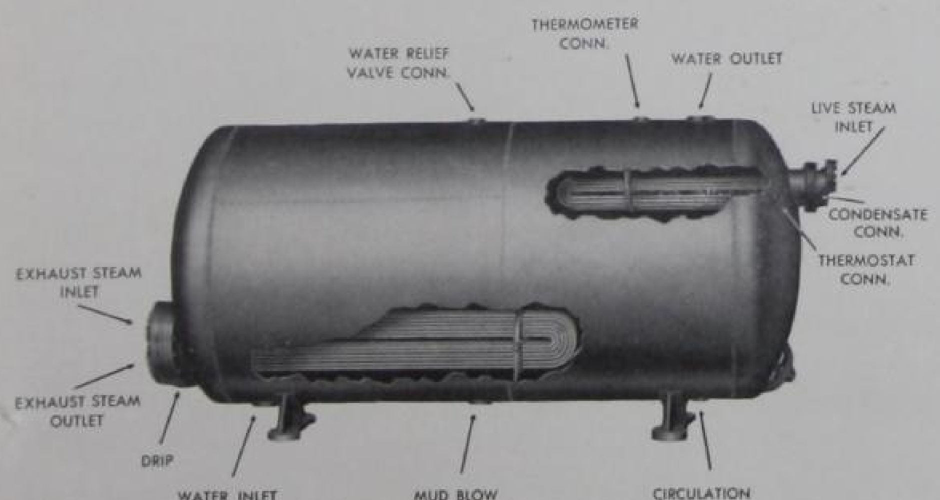


Fig. 2. Type K Storage Heater, Combination Design

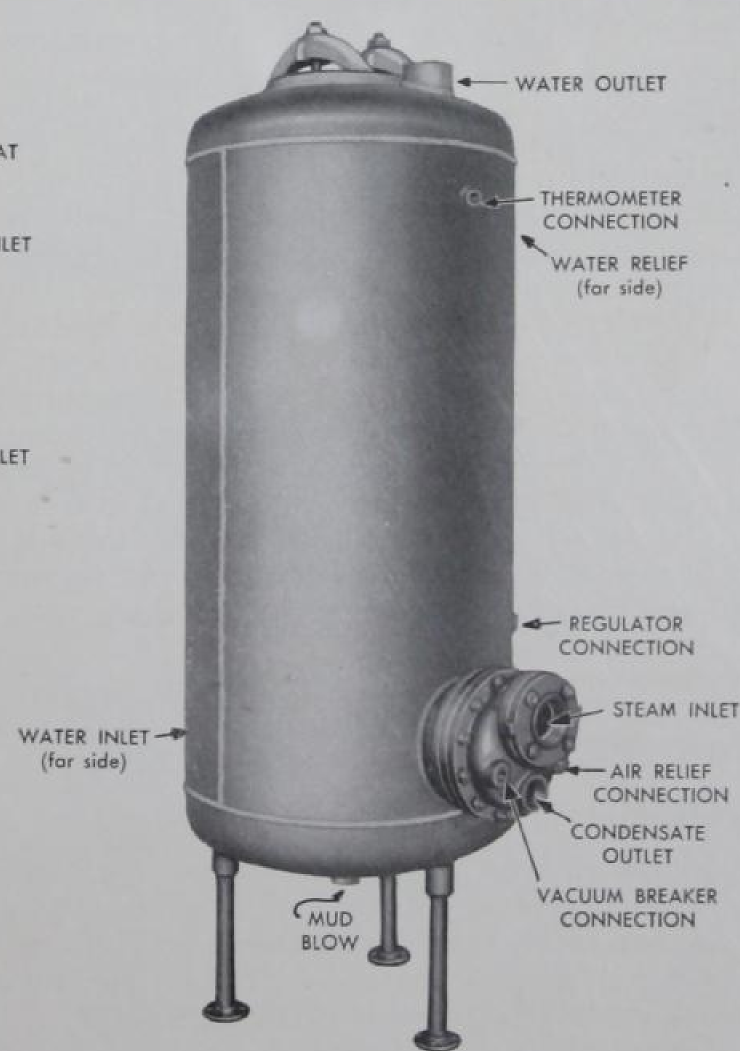


Fig. 3. Type K Storage Heater, Vertical Design

MATERIALS OF CONSTRUCTION

The shells and heads of Whitlock Type K Storage Heaters may be constructed of carbon steel, stainless steel, Everdur, copper, nickel, or of any other material which can be formed and welded, including also stainless steel-clad steel or nickel-clad steel, etc. The choice of materials depends upon the local water conditions, purity of hot water desired, and, of course, the economic considerations.

STANDARD STEEL SHELL HEATERS

It is well known that steel in contact with water is generally subject to corrosion. This is particularly true of steel in contact with water which is being heated, because the oxygen released as the water temperature is raised attacks the steel, producing iron oxide or rust. As a general rule, however, the rate of corrosion, rusting or pitting is slow — so slow, in fact, that many Whitlock Type K Storage Heaters with steel shells which were installed over a quarter of a century ago are still in satisfactory every day service. Corrosion or pitting is quite independent of the grade or class of steel used, and the rate of corrosion or pitting is much more rapid in some localities than in others. It is good practice, therefore, to add a corrosion allowance of 1/16″ to 1/8″ to the thicknesses shown in the tables on Pages 8 and 9.

NOTE: It is not necessary and is actually more expensive to specify a higher design pressure than conditions warrant instead of specifying a corrosion allowance. For example, in specifying an A.S.M.E. 60″ x 168″ Type K Storage Heater for 100# design pressure, the minimum thickness required for 100# design pressure is 3/8″ shell and 7/16″ heads. If a heavier shell is preferred, say, 5/8″ x 3/4″ (to insure longer life against corrosion) it will be noted that this heavier thickness appears under the heading of 175# design pressure. However, if the design pressure is specified as 175#, it is necessary to design the bolted joints and all other parts for the full working pressure of 175#, which results in an unnecessary expense. The specifications should read as follows:

> "Furnish 1 — Whitlock 60″ x 168″ Type K Storage Heater designed for 100# per sq. in. working pressure, shell to be 5/8″ thick with 3/4″ thick heads".

The low cost of Whitlock Type K Storage Heaters with steel shells favors their use in buildings where slow corrosion is tolerable.

EVERDUR SHELL HEATERS

The Whitlock-Everdur Type K Storage Heater is standard equipment for installations where the water is known to be actively corrosive to steel and in installations where it is imperative that the hot water be not contaminated with iron oxide.

Everdur is a silicon bronze with a corrosion resistance comparable with copper and having a tensile strength comparable with that of steel. Whitlock-Everdur Heaters are equipped with non-ferrous tube sheets, tubes and manhole covers so that the water passing through the shell comes in contact with nothing but non-ferrous metals.

ETERNO (COPPER-LINED) HEATERS

Whitlock-Eterno Heaters have a flange quality steel shell lined with electrolytic sheet copper. The steel shell is sufficiently heavy to accommodate the full working water pressure, while the sheet copper is of a thickness ample to prevent corrosion.

Extreme care is taken in the forming, fitting, and joining of the copper sheet to assure tightness and to assure protection of the steel shell.

Small tapped openings are made through Everdur spuds welded to both the steel shell and to the copper inner shell. Larger connections are made through a sleeve of copper which is rolled back over the outer shell flange.

ALLOY SHELL HEATERS

Where conditions demand their application, stainless steel, nickel, monel and stainless steel-clad or nickel-clad shells can and have been furnished. Your local Whitlock representative will be glad to examine your individual requirements and offer recommendations.

NON-METALLIC COATED STEEL SHELL HEATERS

The application of non-metallic coatings—enamels, plastics, cement, etc. to the interior surface of a steel shell — provide low cost protection against shell corrosion. Whitlock Manufacturing Standards cover detailed procedure and steps for the effective application of approved coatings. Recommendations are available upon request.

SPECIFICATIONS

Both shell and heating elements of Whitlock Type K Storage Heaters are hydrostatically tested to pressures required by the customer, state regulations or special codes. In lieu of an indicated test requirement, Whitlock Manufacturing Standards require that the heater be tested at a pressure not less than 150% of the specified working water pressure.

Construction is available according to Whitlock Manufacturing Standards, A.S.M.E. Code for Unfired Pressure Vessels, and other special codes.

WHITLOCK INSTALLATIONS

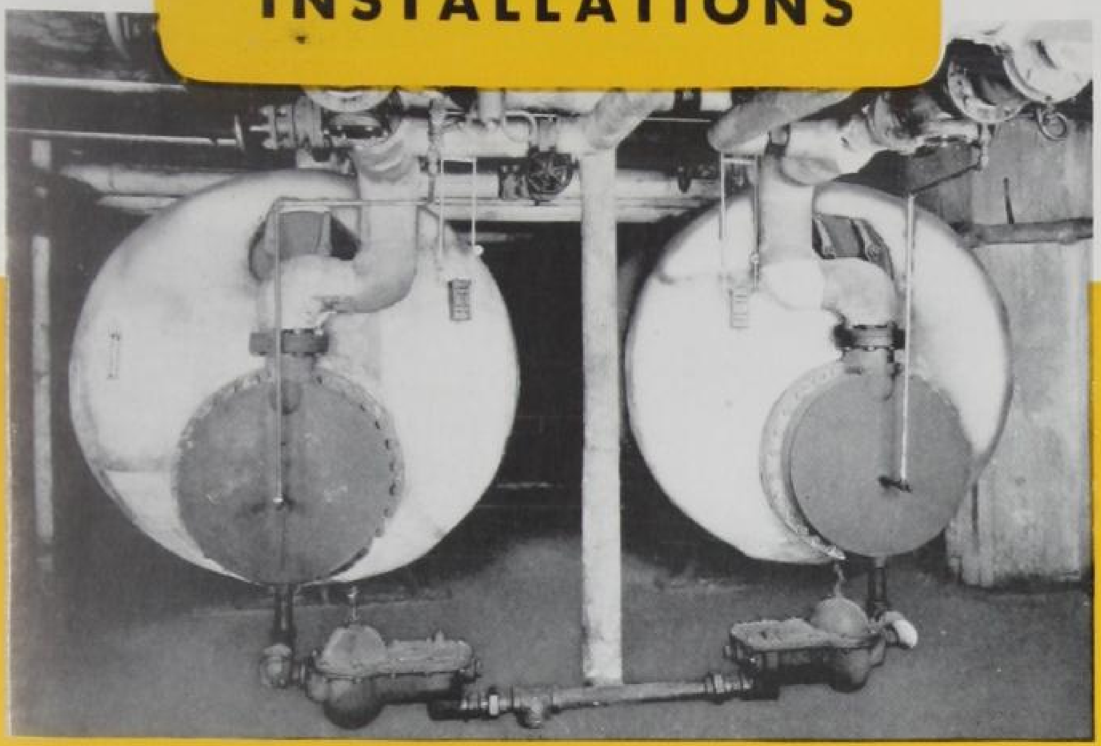


Fig. 4. Central Y.M.C.A., Minneapolis, Minn.

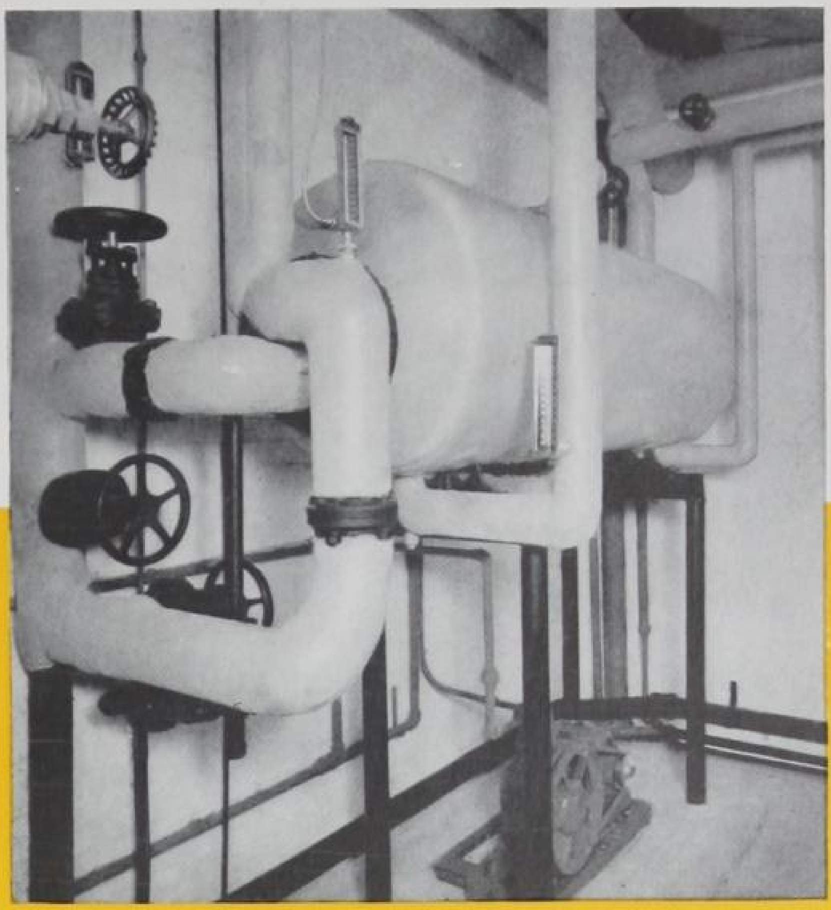


Fig. 5. Station KYW Studios, Philadelphia, Pa.

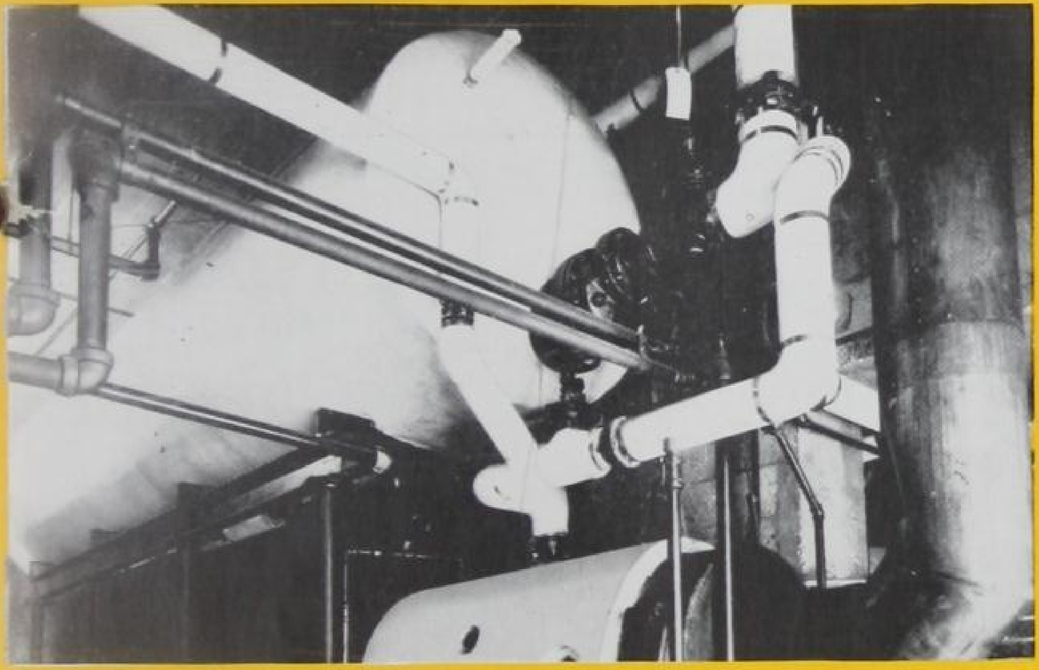


Fig. 6. Marlboro Apartments, Seattle, Wash.

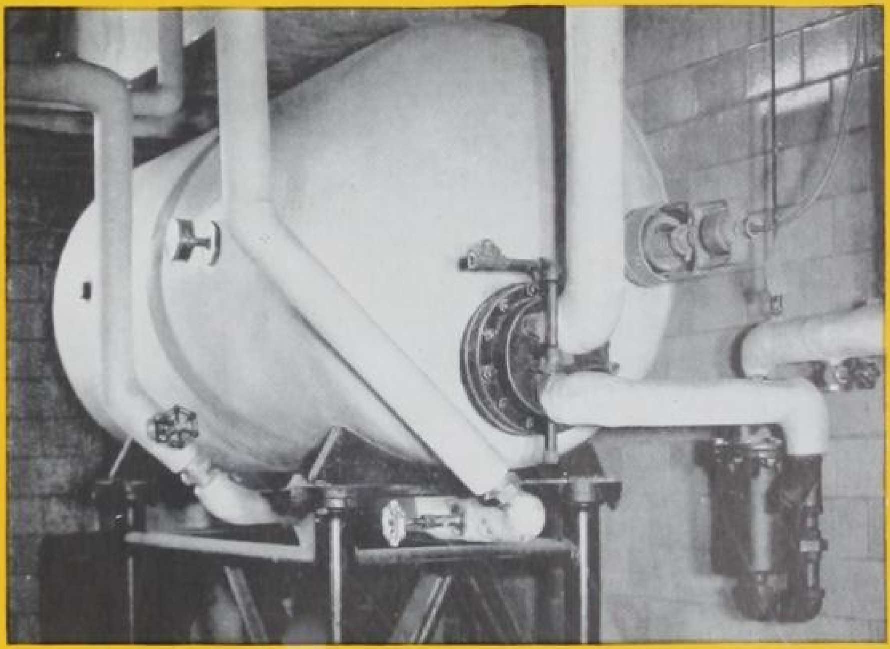


Fig. 7. Miami University, Oxford, Ohio

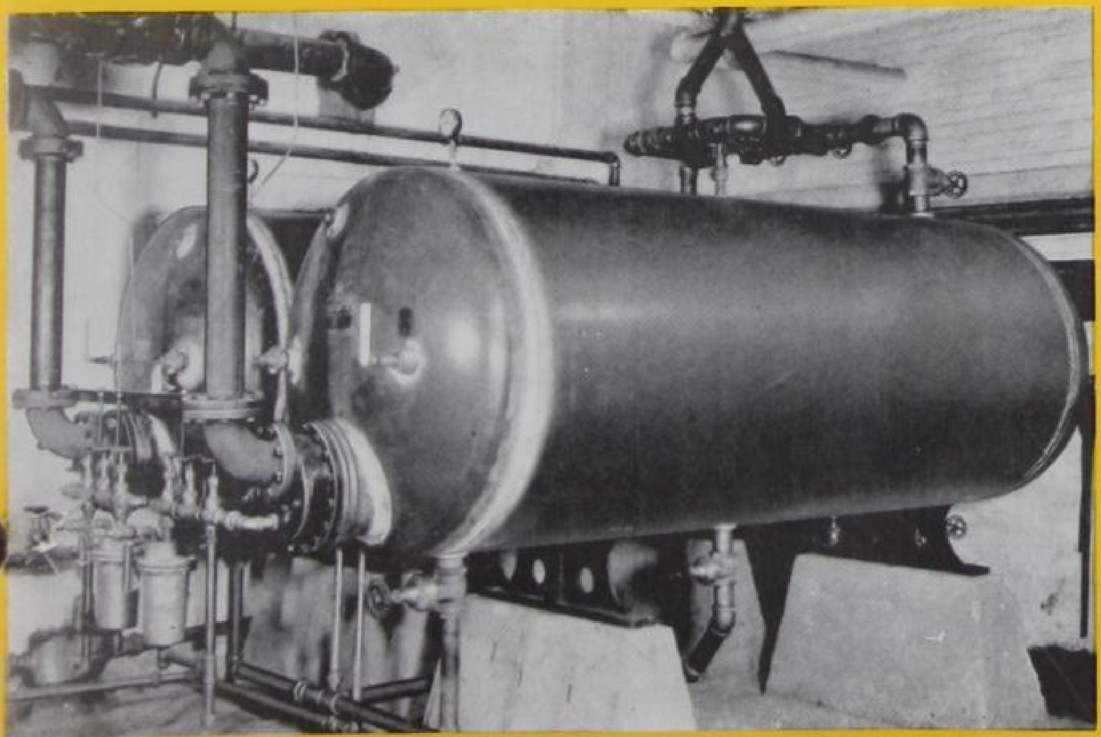


Fig. 8. Norwalk General Hospital, Norwalk, Conn.

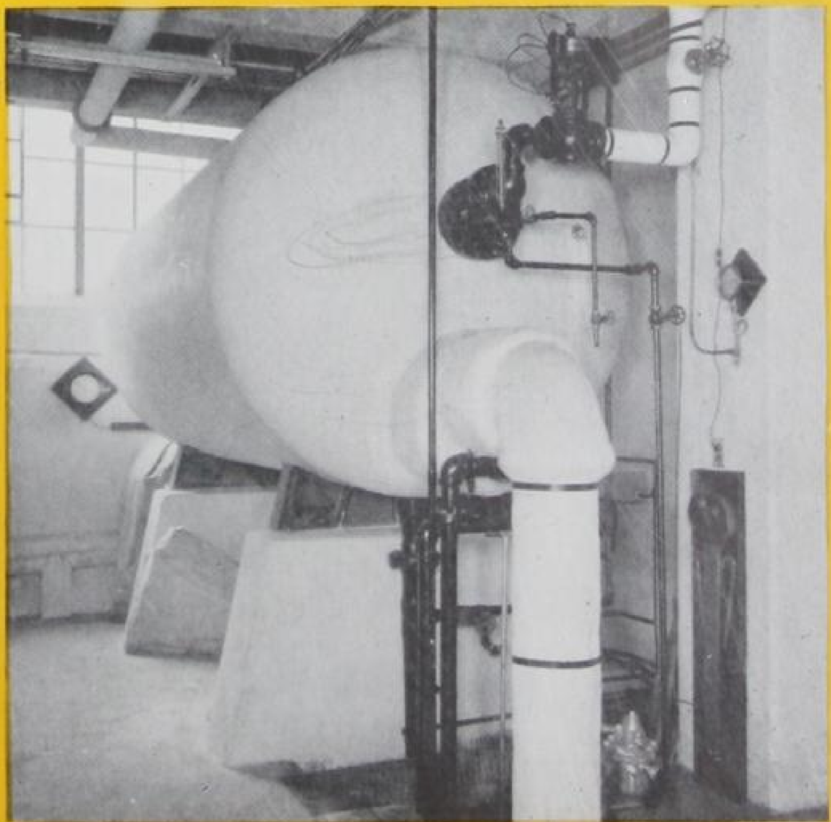
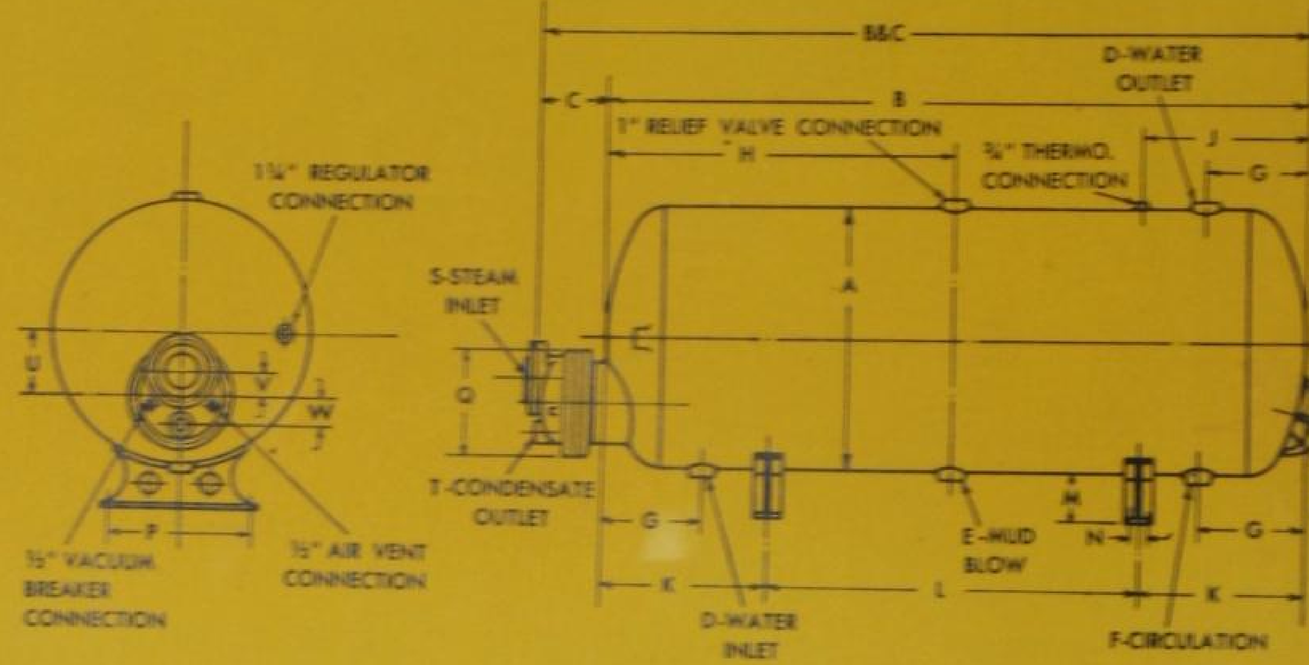


Fig. 9. Manheim Laundry, Philadelphia, Pa.

HORIZONTAL STORAGE HEATER DIMENSIONS



18" and 24" diameter shells have 6" x 8" handhole on centerline.

30" diameter to and including 48" diameter shells have 11" x 15" manhole on centerline.

54" diameter and larger shells have 11" x 15" manhole off centerline, as shown.

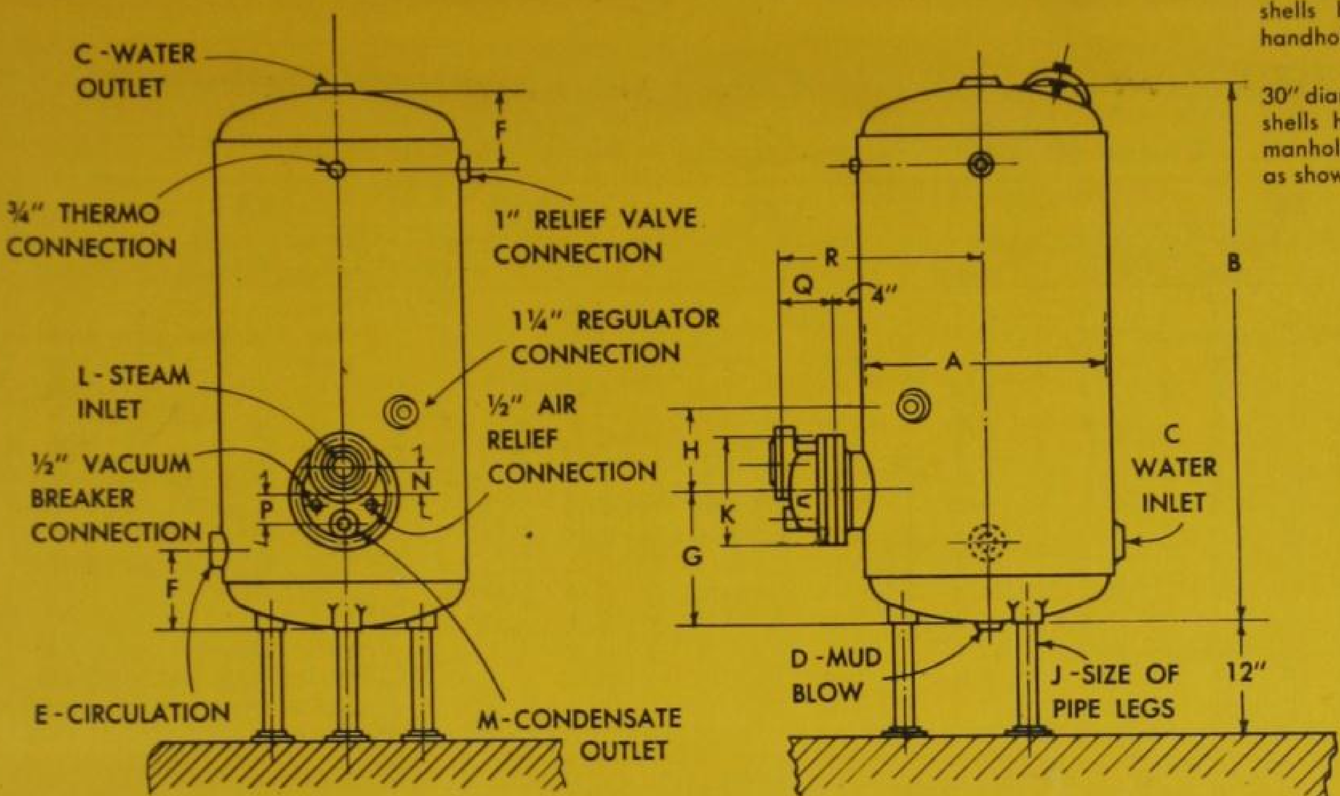
TABLE A—Shells

Number	Gallons—one filling	A—Diam. shell, in.	B—Length, in. add C—for overall	Weight—lbs. Approx.	D—Water inlet and outlet, in.	E—Mud blow, in.	F—Circulation, in.	G—Location of water connections, in.	H—Location of mud blow, in.	J—Location of thermometer, in.	K—Location of cradles, in.	L—c. c. of cradles, in.	Standard Cradles: M—Height, in.	Standard Cradles: N—c. c. of bolt holes, in.	Standard Cradles: P—c. c. of bolt holes, in.	Pipe Leg Cradles: N—Diam. of pipe legs, in.	Pipe Leg Cradles: P—c. c. of pipe legs, in.
1	60	18	60	400	2	2	—	10	30	22	18	24	1⅞	1½	11	1¼	12¾
2	75	18	72	450	2	2	—	10	36	22	18	36	1⅞	1½	11	1¼	12¾
3	110	24	60	600	2	2	—	11	30	23	19	22	1⅞	1¾	14	1¼	17
4	130	24	72	700	2	2	—	11	36	23	19	34	1⅞	1¾	14	1¼	17
5	150	24	84	800	2	2	—	11	42	23	19	46	1⅞	1¾	14	1¼	17
6	170	30	60	750	3	2	—	12	30	24	20	20	3	1¾	19	2½	21¼
7	200	30	72	850	3	2	—	12	36	24	20	32	3	1¾	19	2½	21¼
8	240	30	84	950	3	2	—	12	42	24	20	44	3	1¾	19	2½	21¼
9	280	30	96	1050	3	2	—	12	48	24	20	56	3	1¾	19	2½	21¼
10	340	36	84	1300	3	2	—	14	42	26	22	40	3	1¾	21½	2½	24¾
11	400	36	96	1450	3	2	—	14	48	26	22	52	3	1¾	21½	2½	24¾
12	450	36	108	1600	3	2	—	14	54	26	22	64	3	1¾	21½	2½	24¾
13	500	36	120	1800	3	2	2	14	60	26	22	76	3	1¾	21½	2½	24¾
14	530	42	96	1850	4	2	2	17	48	29	26	44	3	2	25½	2½	29½
15	680	42	120	2150	4	2	2	17	60	29	26	68	3	2	25½	2½	29½
16	800	42	144	2500	4	2	2	17	72	29	26	92	3	2	25½	2½	29½
17	970	42	168	2900	4	2	2	17	76	29	42	84	3	2	25½	2½	29½
18	870	48	120	2850	4	2	2	18	60	30	27	66	2⅞	2	29	3	34
19	1050	48	144	3250	4	2	2	18	72	30	27	90	2⅞	2	29	3	34
20	1250	48	168	3700	4	2	2	18	76	30	27	114	2⅞	2	29	3	34
21	1400	48	192	4100	4	2	2	18	88	30	27	138	2⅞	2	29	3	34
22	1100	54	120	3250	4	2	2	20	60	32	30	60	2⅞	2	33	3	38
23	1300	54	144	3700	4	2	2	20	72	32	30	84	2⅞	2	33	3	38
24	1500	54	168	4200	4	2	2	20	76	32	30	108	2⅞	2	33	3	38
25	1800	54	192	4700	4	2	2	20	88	32	30	132	2⅞	2	33	3	38
26	1300	60	120	4300	4	2	2	20	60	32	30	60	3	2	37	3	42½
27	1600	60	144	4900	4	2	2	20	72	32	30	84	3	2	37	3	42½
28	1900	60	168	5600	4	2	2	20	76	32	30	108	3	2	37	3	42½
29	2200	60	192	6200	4	2	2	20	88	32	30	132	3	2	37	3	42½
29A	1950	66	144	5300	4	2	2	22	76	34	32	80	3	2	41	4	46½
29B	2300	66	168	6000	4	2	2	22	76	34	32	104	3	2	41	4	46½
29C	2650	66	192	7150	4	2	2	22	88	34	32	128	3	2	41	4	46½
30	2300	72	144	5700	4	2½	2½	23	72	35	34	76	3	4	40	4	51
31	2700	72	168	6400	4	2½	2½	23	76	35	34	100	3	4	40	4	51
32A	2700	78	144	7200	4	2½	2½	24	72	36	36	72	3	4	40	4	55¼
32B	3200	78	168	8050	4	2½	2½	24	76	36	36	96	3	4	40	4	55¼
32C	3700	78	192	8900	4	2½	2½	24	88	36	36	120	3	4	40	4	55¼

TABLE B—Heating Elements

Number	Gallons per hour 40°-180°F. steam at 0#	Smallest shell length into which section will fit, in.	Weight of entire section—lbs.	Q—Diam. of head port, in.	C—Add to B for over all, in.	S—Max. and std. steam inlet, in.	T—Max. and std. condensation, in.	U—Center heater to center of section	V—Location of steam inlet, in.	W—Location of
H0	100	48	75	9¼	6¼	2	1	Approx. ½ "A"—½ "Q" or ½ Diam. Shell Minus ½ Diam. Head Port	1⁵⁄₁₆	2
H1	150	60	80	9¼	6¼	2	1		1⁵⁄₁₆	2
H2	200	72	90	9¼	6¼	2	1		1⁵⁄₁₆	2
H3	250	84	100	9¼	6¼	2	1		1⁵⁄₁₆	2
H4	300	108	110	9¼	6¼	2	1		1⁵⁄₁₆	2
H5	350	120	115	9¼	6¼	2	1		1⁵⁄₁₆	2
H6	400	60	200	12½	7½	3	2		2¾	3
H7	500	72	210	12½	7½	3	2		2¾	3
H8	550	72	215	12½	7½	3	2		2¾	3
H9	600	84	220	12½	7½	3	2		2¾	3
H10	700	96	250	12½	7½	3	2		2¾	3
H11	800	96	260	12½	7½	3	2		2¾	3
H12	900	108	270	12½	7½	3	2		2¾	3
H13	1000	120	285	12½	7½	3	2		2¾	3
H14	1250	84	370	15¼	7½	5	2		2¾	4
H15	1500	108	425	15¼	7½	5	2		2¾	4
H16	1750	120	450	15¼	7½	5	2		2¾	4
H17	2000	96	570	18¼	8½	6	2½		3¼	5
H18	2400	120	620	18¼	8½	6	2½		3¼	5
H18A	2500	120	630	18¼	8½	6	2½		3¼	5
H19	2800	132	670	18¼	8½	6	2½		3¼	5
H19A	3000	132	695	18¼	8½	6	2½		3¼	5
H20	3200	96	860	21	9⅜	8	2½		4⁵⁄₁₆	6
H20A	3500	108	905	21	9⅜	8	2½		4⁵⁄₁₆	6
H21	3600	108	920	21	9⅜	8	2½		4⁵⁄₁₆	6
H22	4000	120	950	21	9⅜	8	2½		4⁵⁄₁₆	6
H23	4400	132	1020	21	9⅜	8	2½		4⁵⁄₁₆	6
H23A	4500	132	1040	21	9⅜	8	2½		4⁵⁄₁₆	6
H24	4800	96	1200	24	9⅝	10	3		5⁵⁄₁₆	8
H24A	5000	96	1235	24	9⅝	10	3		5⁵⁄₁₆	8
H25	5400	108	1300	24	9⅝	10	3		5⁵⁄₁₆	8
H26	6000	120	1380	24	9⅝	10	3		5⁵⁄₁₆	8
H27	7000	108	1900	28	11	10	3		6⅝	9
H27A	7500	108	1965	28	11	10	3		6⅝	9
H28	8000	120	2030	28	11	10	3		6⅝	9
H29	9000	132	2160	28	11	10	3		6⅝	9
H30	10000	144	2300	28	11	10	3		6⅝	9

VERTICAL STORAGE HEATER DIMENSIONS



18" and 24" diameter shells have 6" x 8" handhole off centerline.

30" diameter and larger shells have 11" x 15" manhole off centerline, as shown.

TABLE C—Shells

Number	Gallons—one filling	A—Diam. shell, in.	B—Length of shell, in.	Weight—lbs. approx.	C—Water inlet and outlet, in.	D—Mud blow, in.	E—Circulation, in.	F—Location water inlet, circulation, thermometer, and relief valve, in.	G—Location of heating section, in.	H—Location of regulator conn., in.	Pipe Leg Support: Number per unit	Pipe Leg Support: J—Size of pipe, in.
1V	60	18	60	400	2	2	...	10	12	9	3	¾
2V	75	18	72	450	2	2	...	10	12	9	3	¾
3V	110	24	60	600	2	2	...	11	15	10	3	1¼
4V	130	24	72	700	2	2	...	11	15	10	3	1¼
5V	150	24	84	800	2	2	...	11	15	10	3	1¼
6V	170	30	60	750	3	2	...	12	17	11	3	1¼
7V	200	30	72	850	3	2	...	12	17	11	3	1¼
8V	240	30	84	950	3	2	...	12	17	11	3	1¼
9V	280	30	96	1050	3	2	...	12	17	11	3	1¼
10V	340	36	84	1300	3	2	...	14	19	11	3	2½
11V	400	36	96	1450	3	2	...	14	19	11	3	2½
12V	450	36	108	1600	3	2	...	14	19	11	3	2½
13V	500	36	120	1800	3	2	2	14	19	11	3	2½
14V	530	42	96	1850	4	2	...	17	21	13	3	2½
15V	680	42	120	2150	4	2	2	17	21	13	3	2½
16V	800	42	144	2500	4	2	2	17	23	15	3	2½
17V	970	42	168	2900	4	2	2	17	23	15	3	2½
18V	870	48	120	2850	4	2	2	18	24	15	3	2½
19V	1050	48	144	3250	4	2	2	18	27	18	3	2½
20V	1250	48	168	3700	4	2	2	18	27	18	3	2½
21V	1400	48	192	4100	4	2	2	18	27	18	3	2½
22V	1100	54	120	3250	4	2	2	20	29	18	3	3
23V	1300	54	144	3700	4	2	2	20	29	18	3	3
24V	1500	54	168	4200	4	2	2	20	29	18	3	3
25V	1800	54	192	4700	4	2	2	20	29	18	3	3
26V	1300	60	120	4300	4	2	2	20	33	20	3	3
27V	1600	60	144	4900	4	2	2	20	33	20	3	3
28V	1900	60	168	5600	4	2	2	20	33	20	3	3
29V	2200	60	192	6200	4	2	2	20	33	20	3	3

TABLE D—Heating Elements

Number	Gallons per hour 40°—180°F. steam at 0#	Minimum shell diameter section will fit, in.	Weight of entire section—lbs.	K—Diameter of tube section and port, in.	L—Maximum and standard steam inlet, in.	M—Maximum and standard condensation, in.	N—Location of steam inlet, in.	P—Location of condensation, in.	Q—Face of port to face of steam inlet, in.	R—Distance from center of shell to face of steam inlet, in.
HV-1	150	18	160	12½	3	2	2¾	3⅜	5	18
HV-2	200	24	170	12½	3	2	2¾	3⅜	5	21
HV-3	250	24	250	12½	3	2	2¾	3⅜	5	21
HV-4	300	36	255	12½	3	2	2¾	3⅜	5	27
HV-5	350	36	260	12½	3	2	2¾	3⅜	5	27
HV-6	400	42	335	12½	3	2	2¾	3⅜	5	30
HV-7	500	30	340	15¼	5	2	2¾	4½	5	24
HV-8	550	30	350	15¼	5	2	2¾	4½	5	24
HV-9	600	36	360	15¼	5	2	2¾	4½	5	27
HV-10	700	36	375	15¼	5	2	2¾	4½	5	27
HV-11	800	42	385	15¼	5	2	2¾	4½	5	30
HV-12	900	36	400	18¼	6	2½	3¼	5½	6	28
HV-13	1000	42	415	18¼	6	2½	3¼	5½	6	31
HV-14	1250	48	570	18¼	6	2½	3¼	5½	6	34
HV-15	1500	42	600	21	8	2½	4 5/16	6⅞	6⅞	31⅞
HV-16	1750	48	790	21	8	2½	4 5/16	6⅞	6⅞	34⅞
HV-17	2000	54	830	21	8	2½	4 5/16	6⅞	6⅞	37⅞
HV-18	2400	60	880	21	8	2½	4 5/16	6⅞	6⅞	40⅞
HV-19	2800	54	1340	24	10	3	5 5/16	8⅛	7⅛	38⅛
HV-20	3200	60	1430	24	10	3	5 5/16	8⅛	7⅛	41⅛
HV-21	3600	66	1470	24	10	3	5 5/16	8⅛	7⅛	44⅛
HV-22	4000	72	1510	24	10	3	5 5/16	8⅛	7⅛	47⅛
HV-23	4400	72	1560	28	10	3	6⅝	9⅞	7¾	47¾
HV-24	4800	72	1600	28	10	3	6⅝	9⅞	7¾	47¾
HV-25	5400	72	1700	28	10	3	6⅝	9⅞	7¾	47¾
HV-26	6000	84	1800	28	10	3	6⅝	9⅞	7¾	53¾
HV-27	7000	84	2440	30	12	4	6½	10½	8⅜	54⅜
HV-28	8000	84	2500	30	12	4	6½	10½	8⅜	54⅜
HV-29	9000	84	2880	36	14	5	7 7/16	12¾	10	56
HV-30	10000	84	3070	36	14	5	7 7/16	12¾	10	56

PRESSURE THICKNESS TABLES STEEL SHELL HEATERS

CORROSION ALLOWANCE: As steel is subject to moderate corrosion by oxygen released from water being heated, it is good practice to add an allowance of $\frac{1}{16}''$ to $\frac{1}{8}''$ to the pressure thickness to act as corrosion allowance for greater durability.

TABLE E — Whitlock Standard Steel Shell and Head Thicknesses

Design Pressure lbs. per sq. in. — Dimensions in Inches

SHELL DIAM.	75 THICKNESS		100 THICKNESS		125 THICKNESS		150 THICKNESS		175 THICKNESS		200 THICKNESS	
	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD
18	1/4	3/8	1/4	3/8	1/4	3/8	1/4	3/8	1/4	3/8	1/4	3/8
24	1/4	3/8	1/4	3/8	1/4	3/8	1/4	3/8	1/4	3/8	5/16	1/2
30	1/4	3/8	1/4	3/8	1/4	3/8	5/16	1/2	5/16	1/2	3/8	1/2
36	1/4	3/8	1/4	3/8	5/16	1/2	5/16	1/2	3/8	1/2	7/16	9/16
42	1/4	3/8	1/4	3/8	5/16	1/2	3/8	1/2	7/16	9/16	9/16	11/16
48	5/16	1/2	5/16	1/2	3/8	1/2	7/16	9/16	9/16	11/16	5/8	3/4
54	3/8	1/2	3/8	1/2	7/16	9/16	1/2	5/8	9/16	11/16	5/8	3/4
60	3/8	1/2	3/8	1/2	7/16	9/16	9/16	11/16	5/8	3/4	3/4	7/8
66	3/8	1/2	3/8	1/2	1/2	5/8	9/16	11/16	3/4	7/8	3/4	15/16
72	5/16	1/2	1/2	5/8	9/16	11/16	5/8	3/4	3/4	7/8	7/8	1
78	3/8	1/2	1/2	5/8	9/16	11/16	3/4	7/8	13/16	1	15/16	1-1/8
84	3/8	1/2	1/2	5/8	5/8	3/4	3/4	15/16	7/8	1-1/16	1	1-3/16
96	7/16	9/16	9/16	11/16	3/4	7/8	7/8	1-1/16	1	1-1/4	1-1/8	1-3/8
108	1/2	5/8	3/4	7/8	7/8	1	15/16	1-3/16	1-1/16	1-3/8	1-1/4	1-9/16
120	9/16	11/16	3/4	7/8	7/8	1-1/8	1-1/16	1-5/16	1-3/16	1-9/16	1-3/8	1-3/4

TABLE F — Minimum Steel Shell and Head Thicknesses Furnished for A.S.M.E. Code Stamped Heaters

Design Pressure lbs. per sq. in. — Dimensions in Inches

SHELL DIAM.	75 THICKNESS		100 THICKNESS		125 THICKNESS		150 THICKNESS		175 THICKNESS		200 THICKNESS	
	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD
18	Shell and head thicknesses will not be furnished less than ¼″ although A.S.M.E. Code may allow lesser thicknesses for these conditions.										1/4	5/16
24							1/4	5/16	1/4	3/8	5/16	3/8
30					1/4	5/16	5/16	3/8	5/16	7/16	3/8	1/2
36			1/4	5/16	5/16	3/8	5/16	7/16	3/8	1/2	7/16	9/16
42			1/4	3/8	5/16	7/16	3/8	1/2	7/16	9/16	1/2	11/16
48	1/4	5/16	5/16	3/8	3/8	1/2	7/16	9/16	1/2	11/16	9/16	3/4
54	1/4	5/16	5/16	3/8	7/16	1/2	1/2	9/16	9/16	11/16	5/8	3/4
60	5/16	5/16	3/8	7/16	7/16	9/16	9/16	5/8	5/8	3/4	11/16	7/8
66	5/16	3/8	3/8	1/2	1/2	5/8	9/16	11/16	11/16	13/16	3/4	15/16
72	5/16	3/8	7/16	1/2	9/16	5/8	5/8	3/4	3/4	7/8	13/16	1
78	3/8	7/16	1/2	9/16	9/16	11/16	11/16	7/8	13/16	1	15/16	1-1/8
84	3/8	1/2	1/2	5/8	5/8	3/4	3/4	15/16	7/8	1-1/16	1	1-3/16
96	7/16	9/16	9/16	11/16	11/16	7/8	7/8	1-1/16	1	1-1/4	1-1/8	1-3/8
108	1/2	5/8	5/8	13/16	13/16	1	15/16	1-3/16	1-1/16	1-3/8	1-1/4	1-9/16
120	9/16	11/16	11/16	7/8	7/8	1-1/8	1-1/16	1-5/16	1-3/16	1-9/16	1-3/8	1-3/4

NOTES: Thicknesses are expressed in not less than multiples of sixteenths of an inch. Manhole frame is properly reinforced to meet A.S.M.E. Code requirements, and gasket surface is machined.

Plate and heads as listed in above tables are regularly carried in our stock for many sizes of heaters. Stock is held within a reasonable minimum by eliminating the stocking of less commonly used sizes. Sizes shown in bold face type represent heaters for which raw materials are carried in stock at all times.

FOR ALL WHITLOCK TYPE K STORAGE HEATERS — Shells 30″ in diameter and larger are provided with 11″ x 15″ manhole in one head. Shells smaller than 30″ diameter are provided with 6″ x 8″ handholes.

A.S.M.E. CODE STAMPED HEATERS (TABLES F AND K) — The thicknesses given are in accordance with the rules according to the 1949 A.S.M.E. Code for Unfired Pressure Vessels. These rules were continued in the 1950 Code, accompanied by an alternate basis for design which, in general, permits slightly lesser shell and head thicknesses for a given diameter of shell and a given design pressure, but only when accompanied by compliance with certain additional requirements as to manufacturing procedure, etc.

The implications of these permissive alternate rules have been carefully analyzed and it is our present considered opinion that adherence to the rules of the 1949 Code will give to the user of a steel shell storage type water heater a better value for the investment than adherence to the alternate permissive rules. We are therefore continuing, in this edition of Bulletin No. 40A, the above table unchanged.

There is another consideration which must be kept in mind. A number of states and cities currently require that all storage type water heaters installed within the limits of their respective jurisdictions comply with the requirements of the existing (1949 and earlier) rules of the A.S.M.E. Code for unfired pressure vessels. Until these authorities have formally accepted the 1950 Code, with the alternate permissive rules referred to above, it will presumably be necessary to continue compliance with the 1949 Code in connection with the manufacture of storage type water heaters to be installed within the limits of their respective jurisdictions.

A heater which does not bear the A.S.M.E. clover leaf stamped on the shell is *not constructed* in full accordance with the A.S.M.E. Code. All Whitlock heaters which are constructed in full accordance with the A.S.M.E. Code are so stamped.

LOOK FOR THE CLOVER LEAF.

PRESSURE THICKNESS TABLES EVERDUR SHELL HEATERS

Shell and head thicknesses as they appear in Tables G and K below have been carefully calculated to minimize the effect of stress corrosion cracking which can result with certain water conditions when high stress and temperature levels occur in service.

TABLE G — Minimum Everdur Shell and Head Thicknesses Whitlock Standard Construction

(Test Pressure = 1½ times Design Pressure)
Design Pressure lbs. per sq. in. — Dimensions in Inches

SHELL DIAM.	75 THICKNESS		100 THICKNESS		125 THICKNESS		150 THICKNESS		175 THICKNESS		200 THICKNESS	
	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD
18	0.067	0.107	0.090	0.143	0.112	0.178	0.134	0.214	0.157	0.250	0.178	0.285
24	0.090	0.125	0.120	0.166	0.149	0.208	0.179	0.250	0.209	0.291	0.238	0.334
30	0.112	0.143	0.150	0.190	0.186	0.238	0.224	0.286	0.261	0.333	0.298	0.381
36	0.134	0.178	0.180	0.238	0.224	0.298	0.268	0.358	0.313	0.416	0.357	0.475
42	0.157	0.214	0.210	0.286	0.261	0.357	0.313	0.428	0.365	0.500	0.417	0.571
48	0.179	0.250	0.240	0.333	0.298	0.416	0.358	0.500	0.417	0.583	0.476	0.666
54	0.201	0.286	0.270	0.380	0.336	0.476	0.404	0.570	0.470	0.666	0.535	0.761
60	0.224	0.321	0.300	0.429	0.373	0.536	0.448	0.642	0.522	0.750	0.596	0.856
66	0.246	0.355	0.330	0.476	0.410	0.596	0.492	0.714	0.572	0.831	0.655	0.951
72	0.269	0.393	0.360	0.524	0.447	0.655	0.538	0.785	0.626	0.915	0.714	1.049
78	0.291	0.427	0.390	0.571	0.485	0.715	0.582	0.856	0.676	1.000	0.772	1.142
84	0.314	0.464	0.420	0.619	0.522	0.775	0.627	0.930	0.730	1.081	0.832	1.238
96	0.359	0.535	0.480	0.714	0.596	0.895	0.716	1.072	0.835	1.250	0.951	1.430
108	0.403	0.606	0.540	0.810	0.672	1.010	0.806	1.140	0.940	1.330	1.070	1.525
120	0.447	0.677	0.600	0.904	0.746	1.075	0.895	1.285	1.045	1.500	1.190	1.710

TABLE H — Minimum Everdur Shell and Head Thicknesses A.S.M.E. Code Construction

Design Pressure lbs. per sq. in. — Dimensions in Inches

SHELL DIAM.	75 THICKNESS		100 THICKNESS		125 THICKNESS		150 THICKNESS		175 THICKNESS		200 THICKNESS	
	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD
18	0.084	0.113	0.112	0.150	0.140	0.188	0.168	0.200	0.195	0.205	0.223	0.300
24	0.113	0.132	0.150	0.175	0.188	0.188	0.228	0.263	0.261	0.307	0.298	0.350
30	0.141	0.150	0.188	0.200	0.234	0.250	0.279	0.300	0.326	0.350	0.372	0.400
36	0.169	0.188	0.224	0.250	0.280	0.313	0.335	0.375	0.391	0.438	0.446	0.500
42	0.197	0.225	0.261	0.300	0.327	0.375	0.391	0.450	0.456	0.525	0.521	0.600
48	0.225	0.263	0.299	0.350	0.373	0.438	0.447	0.525	0.522	0.613	0.595	0.700
54	0.253	0.300	0.336	0.400	0.420	0.500	0.502	0.600	0.586	0.700	0.670	0.800
60	0.281	0.338	0.373	0.450	0.466	0.563	0.558	0.675	0.652	0.788	0.743	0.900
66	0.309	0.375	0.411	0.500	0.513	0.625	0.615	0.750	0.716	0.875	0.819	1.000
72	0.337	0.413	0.448	0.550	0.560	0.688	0.670	0.825	0.782	0.963	0.892	1.100
78	0.365	0.450	0.485	0.600	0.606	0.750	0.726	0.900	0.846	1.050	0.966	1.200
84	0.393	0.488	0.523	0.650	0.653	0.813	0.782	0.975	0.913	1.138	1.040	1.300
96	0.449	0.563	0.597	0.750	0.744	0.938	0.894	1.125	1.043	1.313	1.190	1.500
108	0.505	0.638	0.672	0.850	0.840	1.063	1.006	1.200	1.172	1.400	1.340	1.600
120	0.561	0.713	0.746	0.950	0.934	1.125	1.118	1.350	1.302	1.575	1.485	1.800

TABLE K — Minimum Everdur Shell and Head Thicknesses Where Working Pressure Shall Not Exceed 42½% of Test Pressure.*

(For Special Municipal or State Regulations)
Pressure lbs. per sq. in. — Dimensions in Inches.

SHELL DIAM.	Test Pressure 200		Test Pressure 250		Test Pressure 300		Test Pressure 350	
	Working Pressure 85 THICKNESS		Working Pressure 106.25 THICKNESS		Working Pressure 127.5 THICKNESS		Working Pressure 148.75 THICKNESS	
	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD	SHELL	HEAD
18	0.096	0.128	0.120	0.160	0.143	0.192	0.166	0.224
24	0.127	0.149	0.159	0.186	0.191	0.224	0.221	0.261
30	0.159	0.170	0.199	0.213	0.238	0.255	0.277	0.298
36	0.191	0.213	0.238	0.266	0.286	0.319	0.332	0.372
42	0.223	0.255	0.278	0.319	0.333	0.383	0.387	0.446
48	0.254	0.298	0.318	0.372	0.381	0.447	0.443	0.521
54	0.286	0.340	0.358	0.425	0.428	0.510	0.497	0.595
60	0.318	0.383	0.398	0.478	0.476	0.574	0.552	0.670
66	0.349	0.425	0.436	0.531	0.524	0.638	0.609	0.744
72	0.381	0.468	0.476	0.584	0.571	0.702	0.665	0.819
78	0.413	0.510	0.516	0.637	0.618	0.766	0.720	0.893
84	0.445	0.553	0.556	0.690	0.666	0.829	0.775	1.042
96	0.508	0.638	0.635	0.796	0.761	0.957	0.785	1.116
108	0.572	0.723	0.715	0.903	0.856	1.085	0.995	1.190
120	0.635	0.808	0.795	1.009	0.951	1.148	1.103	1.339

*Thicknesses also suitable for A.S.M.E. Code construction for working pressures indicated.

SELECTING PROPER SIZE HEATER

The size of Whitlock Type K Storage Heater required for different types of buildings can be determined from Table L as follows:

Hourly heating capacity = Hourly requirement x Hourly heating capacity factor.

Storage capacity = Hourly heating capacity x Storage capacity factor.

Reference to Tables A to D will show correct size of shell and heating section at once.

EXAMPLE:

To illustrate the above method of selecting the proper heater, take the hot water requirements of a small hotel.

Private lavatories	100 @	2 gals. each	200 gals. per hr.
Public lavartories	10 @	8 gals. each	80 gals. per hr.
Bathtubs	75 @	20 gals. each	1,500 gals. per hr.
Dishwashers	2 @	50 gals. each	100 gals. per hr.
Kitchen sinks	3 @	20 gals. each	60 gals. per hr.
Pantry sinks	2 @	10 gals. each	20 gals. per hr.
Showers	24 @	75 gals. each	1,800 gals. per hr.
Slop sinks	8 @	30 gals. each	240 gals. per hr.
Maximum hourly requirements (total)			4,000 gals. per hr.

Hourly heating capacity equals 4,000 multiplied by 25% (hourly heating capacity factor) or 1,000 gal. per hour.

Storage capacity equals 1,000 multiplied by 80% (storage capacity factor) or 800 gal.

Shell size for 800 gal., No. 16 (42 x 144 in.). Heating section of 1,000 gal. capacity is No. H13. Heater required is Whitlock Type K No. 16H13 (or No. 16V HV13 vertical).

STEAM REQUIRED TO HEAT WATER

The amount of steam per hour required to heat a given quantity of water through any temperature range and with any steam pressure can be determined from the following formula:

$$\frac{\text{Gallons per Hour} \times 8.33 \times \text{Degrees Rise}}{\text{Latent Heat of Steam}} = \text{Pounds of steam per hour.}$$

EXAMPLE: Required the amount of steam at 50 lbs. pressure to heat 10,000 G.P.H. from 40° to 180°.

$$\frac{10{,}000 \times 8.33 \times 140}{911} = 12{,}801 \text{ lbs. steam per hour.}$$

TABLE M — Latent Heat of Steam

Steam Pressure, lbs. gage	0	5	10	15	20	30	35	40
Latent Heat (B.t.u.)	970	960	952	945	939	928	924	919
Steam Pressure, lbs. gage	45	50	55	60	65	70	75	80
Latent Heat (B.t.u.)	915	911	908	904	901	898	893	891

Steam Pressure, lbs. gage	85	90	95	100	105	110	115	120	125
Latent Heat (B.t.u.)	888	886	883	880	877	875	872	870	868

TABLE L — Hot Water Fixture Capacity for Various Types of Buildings

Gallons of 180°F. Water per Hour per Fixture

	Apartment house	Club	Gymnasium	Hospital	Hotel	Industrial plant	Office building	Public bath	Private residence	School	Y. M. C. A.
Basins, private lavatory	2	2	2	2	2	2	2	2	2	2	2
Basins, public lavatory	4	6	8	6	8	12	6	12	..	15	8
Bathtubs	20	20	30	20	20	30	..	45	20	..	30
Dishwashers	15	50-150	..	50-150	50-200	20-100	..	..	15	20-100	20-100
Foot basins	3	3	12	3	3	12	..	..	3	3	12
Kitchen sink	10	20	..	20	20	20	..	..	10	10	20
Laundry, stationary tubs	20	28	..	28	28	..	..	..	20	..	28
Pantry sink	5	10	..	10	10	..	..	..	5	10	10
Showers	75	150	225	75	75	225	..	225	75	225	225
Slop sink	20	20	..	20	30	20	15	15	15	20	20
Hourly heating capacity factor	30%	30%	40%	25%	25%	40%	30%	50%	30%	40%	40%
Storage capacity factor	125%	90%	100%	60%	80%	100%	200%	120%	70%	100%	100%

CONVERSION FACTORS

The heating capacities of standard Whitlock Type K heating elements listed on Pages 6 and 7 are based on heating the indicated flow rates from 40° to 180°F. when using steam at atmospheric pressure. In actual practice, however, conditions such as steam pressure, initial and final temperature may vary considerably from these standards. In order to compensate for these variables we list below suitable Conversion Factors which are generally adequate for installations where the ratio of hourly heating capacity to storage capacity does not exceed approximately 4 to 1.

To apply these factors locate the appropriate steam pressure table, start at the top of this table with the proper initial water temperature, and move down that column to the required outlet water temperature indicated in the vertical columns to the left. The factors thus obtained, when multiplied by the standard ratings on Pages 6 and 7, give ratings for the required conditions. Typical examples of the use of the tables may be helpful:

EXAMPLE NO. 1. Determine capacity of H-13 heating element when heating water from 50° to 150°F. with steam at 25 lbs. gage. Using the tables as indicated above we arrive at a factor of 2.87. With the standard rating of an H-13 heating element 1,000 G.P.H., we multiply 1,000 x 2.87 which gives a rating of 2,870 G.P.H. for the required conditions.

EXAMPLE NO. 2. Determine standard heating element required to heat 2,400 G.P.H. water from 60° to 180°F. when supplied with 40 lbs. gage steam. Again determining the conversion factor as above we arrive at 2.42. Now dividing: 2,400 ÷ 2.42 equals 992 G.P.H. (standard rating). An H-13 heating element with a standard 1,000 G.P.H. rating is satisfactory.

TABLE N — Conversion Factors

STEAM PRESSURE, LBS. GAGE	0			5			10			15			20		
INITIAL TEMP.	40	50	60	40	50	60	40	50	60	40	50	60	40	50	60
FINAL TEMP:															
100	3.93	4.57	5.53	4.41	5.12	6.22	4.81	5.58	6.83	5.14	6.04	7.34	5.47	6.42	7.82
120	2.69	2.98	3.36	3.05	3.38	3.83	3.35	3.72	4.23	3.61	4.02	4.56	3.85	4.30	4.89
140	1.94	2.08	2.26	2.23	2.41	2.61	2.47	2.67	2.91	2.68	2.89	3.16	2.87	3.12	3.41
150	1.65	1.76	1.88	1.92	2.05	2.20	2.15	2.29	2.47	2.33	2.50	2.70	2.51	2.69	2.91
160	1.41	1.48	1.57	1.66	1.76	1.87	1.87	1.99	2.11	2.05	2.17	2.27	2.21	2.35	2.51
180	1.00	1.04	1.08	1.23	1.29	1.34	1.42	1.48	1.56	1.58	1.65	1.73	1.72	1.80	1.90
190	......	......	......	1.05	1.09	1.13	1.23	1.28	1.33	1.38	1.44	1.51	1.52	1.58	1.66
200	......	......	......	0.88	0.906	0.934	1.06	1.09	1.14	1.21	1.25	1.30	1.34	1.39	1.44

STEAM PRESSURE, LBS. GAGE	25			30			40			50			60		
INITIAL TEMP.	40	50	60	40	50	60	40	50	60	40	50	60	40	50	60
FINAL TEMP:															
100	5.75	6.76	8.23	6.03	7.06	8.64	6.53	7.66	9.42	6.99	8.24	10.08	7.40	8.77	10.73
120	4.08	4.54	5.17	4.26	4.78	5.43	4.63	5.18	5.90	4.98	5.58	6.38	5.30	5.93	6.78
140	3.06	3.30	3.62	3.20	3.48	3.82	3.50	3.81	4.20	3.78	4.12	4.52	4.02	4.37	4.81
150	2.67	2.87	3.10	2.81	3.02	3.28	3.09	3.32	3.59	3.34	3.59	3.89	3.55	3.82	4.17
160	2.36	2.50	2.68	2.49	2.64	2.83	2.73	2.91	3.13	2.96	3.17	3.40	3.16	3.37	3.63
180	1.85	1.94	2.04	1.96	2.06	2.17	2.17	2.28	2.42	2.37	2.50	2.64	2.51	2.68	2.83
190	1.64	1.71	1.79	1.74	1.82	1.91	1.95	2.04	2.14	2.13	2.23	2.35	2.29	2.39	2.53
200	1.45	1.51	1.57	1.55	1.61	1.68	1.74	1.81	1.90	1.92	2.00	2.09	2.06	2.15	2.27

STEAM PRESSURE, LBS. GAGE	70			80			90			100			125		
INITIAL TEMP.	40	50	60	40	50	60	40	50	60	40	50	60	40	50	60
FINAL TEMP:															
100	7.84	9.28	11.30	8.25	9.74	11.80	8.60	10.14	12.44	9.00	10.61	13.00	9.84	11.71	15.23
120	5.62	6.30	7.19	5.91	6.65	7.58	6.17	6.94	7.91	6.46	7.28	8.33	7.16	8.05	9.16
140	4.26	4.64	5.13	4.51	4.90	5.42	4.72	5.16	5.66	4.95	5.40	5.97	5.47	5.98	6.60
150	3.78	4.08	4.45	4.00	4.31	4.69	4.17	4.52	4.92	4.38	4.75	5.16	4.87	5.27	5.75
160	3.36	3.60	3.88	3.57	3.89	4.12	3.73	4.00	4.31	3.93	4.20	4.55	4.37	4.67	5.05
180	2.71	2.86	3.04	2.88	3.04	3.23	3.02	3.20	3.39	3.19	3.37	3.58	3.55	3.76	4.00
190	2.45	2.57	2.71	2.60	2.74	2.89	2.75	2.89	3.05	2.86	3.03	3.20	3.23	3.39	3.59
200	2.21	2.32	2.42	2.36	2.47	2.59	2.46	2.61	2.73	2.63	2.74	2.90	2.95	3.08	3.25

CONDENSATE COOLERS

Whitlock Type K Condensate Coolers are designed to cool returns from steam heating systems and steam-actuated equipment, thus partially or completely heating the required service water. The condensate passes through the heating element, giving up its heat to the water in the shell. Specifically, the condensate cooler

(1) effects a considerable fuel saving where the condensate would otherwise be dumped to waste or would flash upon its introduction to a receiver,

(2) cools condensate to a temperature at which it may be returned to the receiver or dumped to waste. In many cities local ordinances forbid the discharge of hot wastes to the sewer.

The Type K Condensate Cooler can be furnished in a standard single element design, with the condensate handling all of the heating load, or in a combination element design, as explained on Page 3, where the condensate as the primary heat source is augmented by live steam as required.

The storage type of condensate cooler is preferable to the instantaneous type when the demand for hot water is intermittent.

The capacity table to be found on this page provides full data for the selection of the suitable heating element size for the required installation. Physical dimensions for these heating elements will be found on pages 6 and 7. To determine the appropriate storage heater shell size refer to sizing data on Page 10. The capacity table below expresses the condensation in terms of pounds per hour and E.D.R. (Equivalent Direct Radiation—square feet). Economically it is reasonable to design the installation to recover as much heat as is possible from the condensate, and ratings are designated for three condensate outlet temperatures.

TABLE P — Capacity of Whitlock Condensation Cooling Sections

(For best economy select cooler large enough to extract most of the waste heat.)

Sq. ft. radiation	Equivalent condensation, lbs. per hr.	Cooling Condensation 200°-125° while heating an equal amount of service water, 50°-125° (Refer to Table B for Shell Sizes Type K Sections will fit)	Cooling Condensation 200°-100° while heating twice the amount of service water, 50°-100° (Refer to Table B for Shell Sizes Type K Sections will fit)	Cooling Condensation 200°-89° while heating three times the amount of service water, 50°-87° (Refer to Table B for Shell Sizes Type K Sections will fit)
1,000	250	H-0	H-0	H-0
1,500	375	H-1	H-1	H-1
2,000	500	H-1	H-2	H-2
2,500	625	H-2	H-3	H-3
3,000	750	H-3	H-4	H-4
3,500	875	H-3	H-5	H-5
4,000	1,000	H-4	H-5	H-6
5,000	1,250	H-5	H-7	H-7
6,000	1,500	H-6	H-8	H-8
7,000	1,750	H-7	H-9	H-10
8,000	2,000	H-8	H-10	H-11
10,000	2,500	H-10	H-12	H-13
12,500	3,125	H-12	H-14	H-14
15,000	3,750	H-13	H-14	H-15
17,500	4,275	H-14	H-15	H-16
20,000	5,000	H-15	H-16	H-17
25,000	6,250	H-16	H-18	H-18
30,000	7,500	H-17	H-19	H-19
35,000	8,750	H-18	H-20	H-20
40,000	10,000	H-19	H-21	H-22

Fig. 10. Installation of Condensation Cooler utilizing condensate from storage heater and building heating system

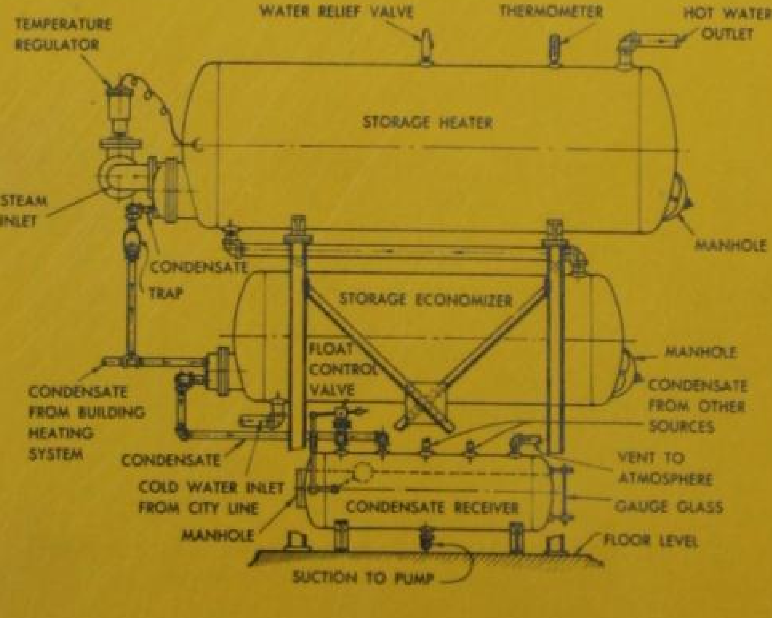
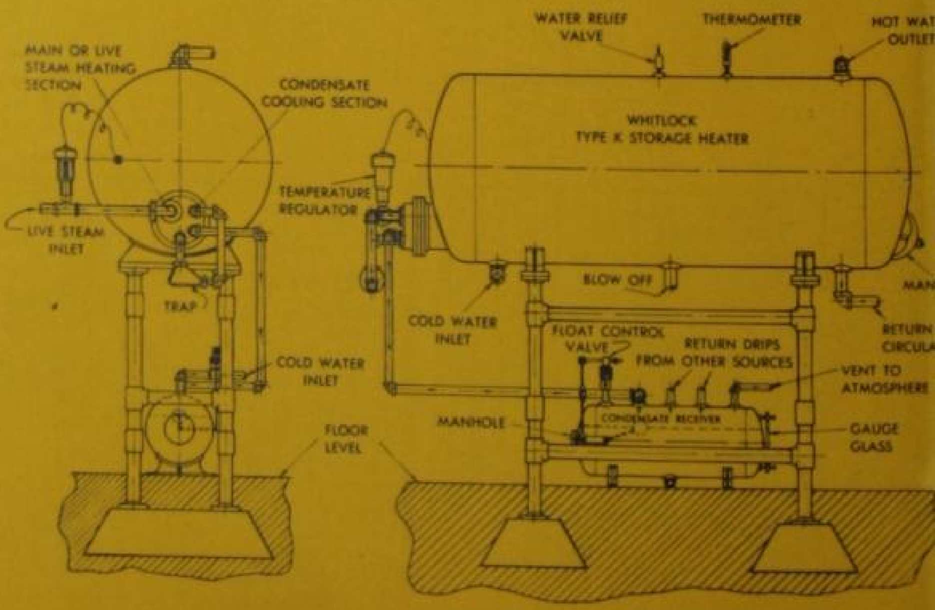


Fig. 11. Installation of Type K Heater with combined heating and condensation cooling section — handling condensation from heating section only



SUBMERGED HEATERS

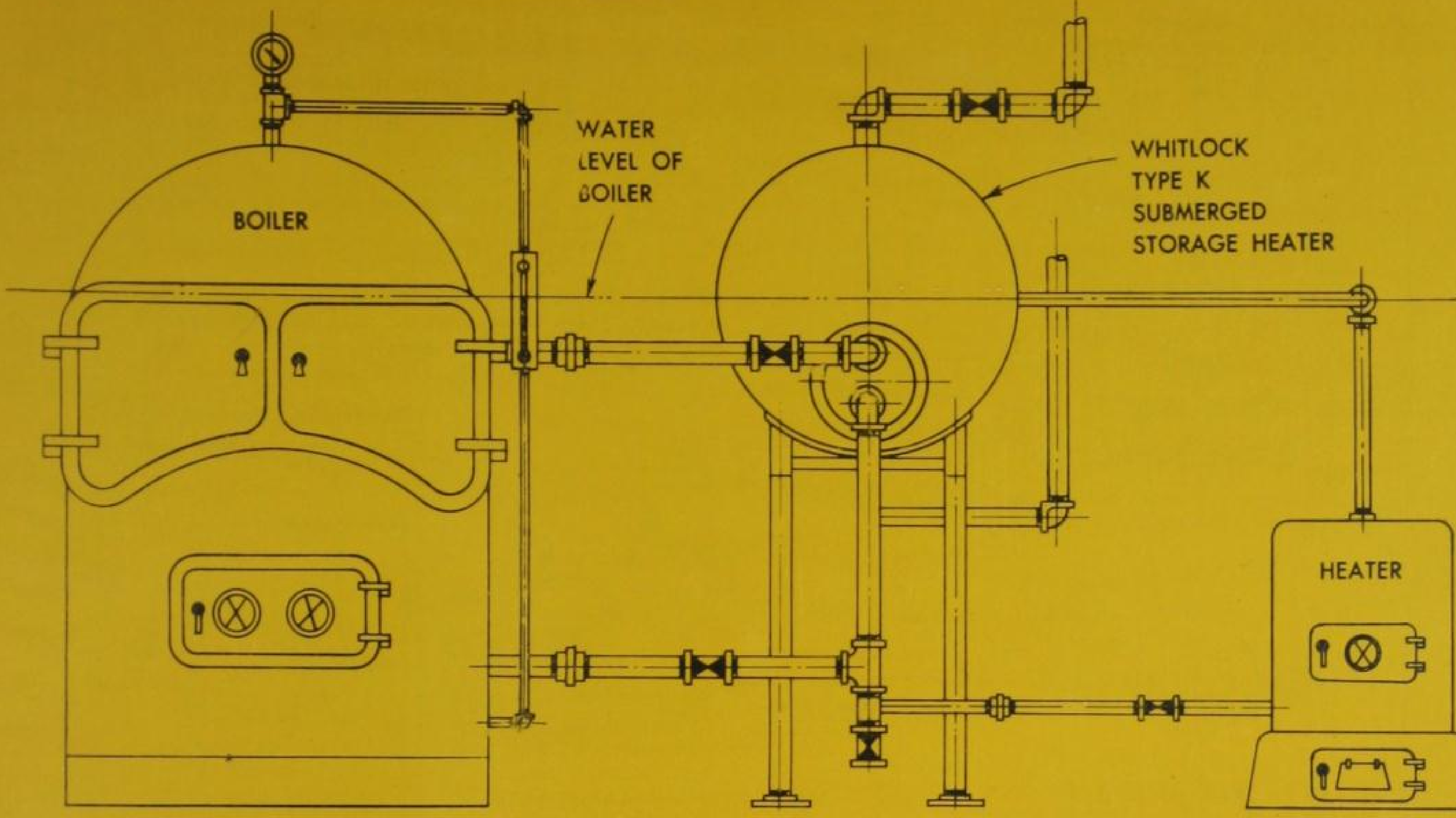


Fig. 12. Installation of Submerged Storage Heater

With the Whitlock Submerged Type K Heater the heating element is placed below the water line of the boiler. Boiler water heats the domestic service supply with a relatively small but steady transfer of heat from boiler water to domestic supply. The removal of heat from the boiler in this manner, since the amount is relatively small and is steady, does not appreciably reduce the steaming capacity of the boiler.

Advantages include:

1. Lower head room required which does away with the necessity of additional excavation.
2. Condensation return troubles eliminated.
3. Hot water available at all hours.
4. Automatic temperature control usually not necessary.

Typical below-the-water line ratings for standard Type K heating elements are included in the table at the right.

TABLE Q

Gallons Per Hour Ratings

BOILER WATER TEMPERATURE	212°F.		200°F.		180°F.	
SERVICE WATER TEMPERATURE RANGE	40°–140°F.	50°–150°F.	40°–140°F.	50°–150°F.	40°–140°F.	50°–150°F.
WHITLOCK HEATING ELEMENT SIZE						
H-0	72	65	64	57	49	41
H-1	108	97	95	84	73	62
H-2	144	130	127	113	98	83
H-3	180	162	158	141	122	103
H-4	217	195	191	170	147	124
H-5	252	227	222	198	171	145
H-6	289	260	255	226	196	166
H-7	361	325	318	282	245	207
H-8	390	351	343	305	265	224
H-9	433	390	382	339	294	249
H-10	505	455	445	396	343	290
H-11	577	520	509	452	392	332
H-12	650	585	572	508	441	373
H-13	722	650	637	566	488	414
H-14	903	812	794	707	612	518
H-15	1082	975	955	848	735	622

WHITLOCK
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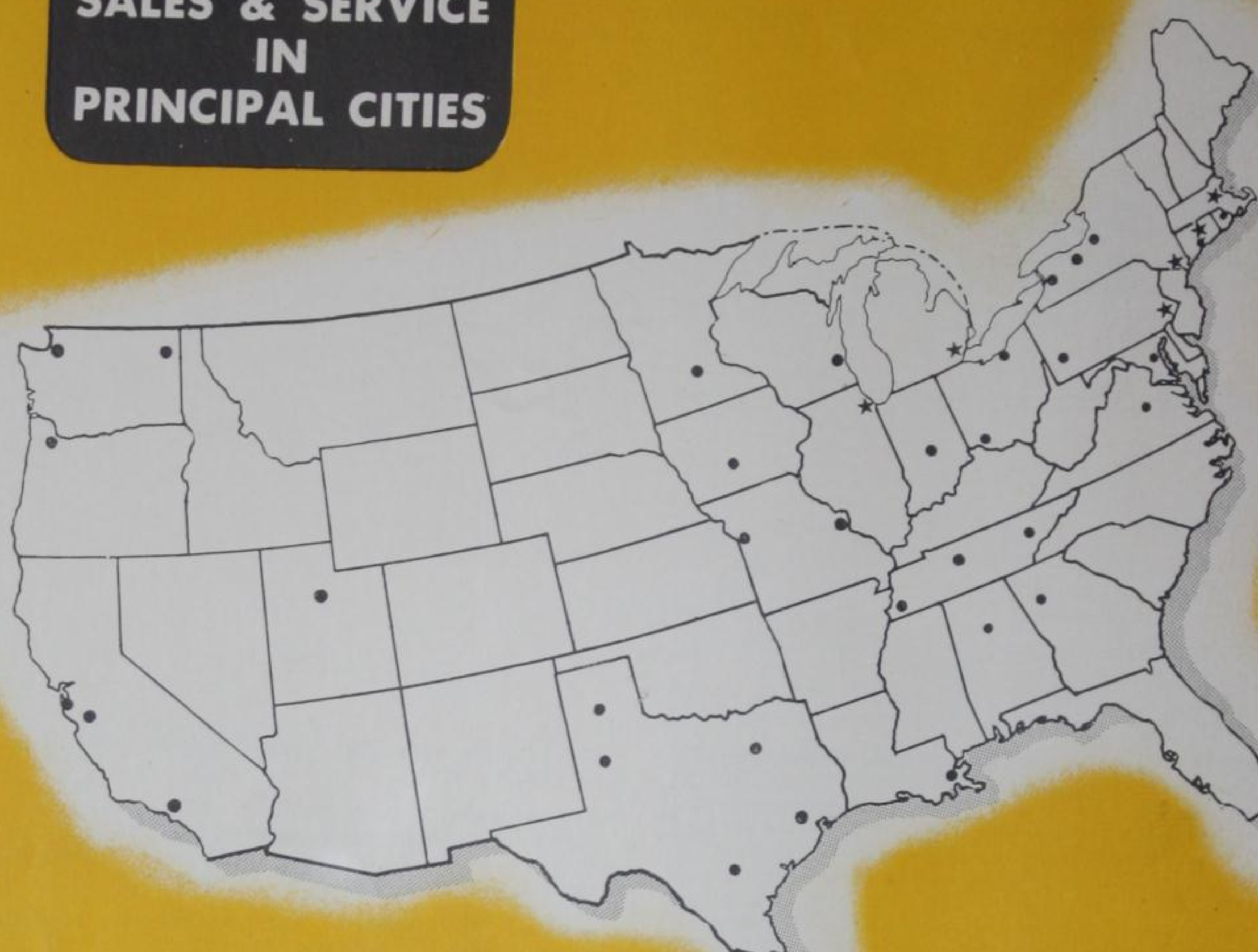

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A better way . . . . A better job ★

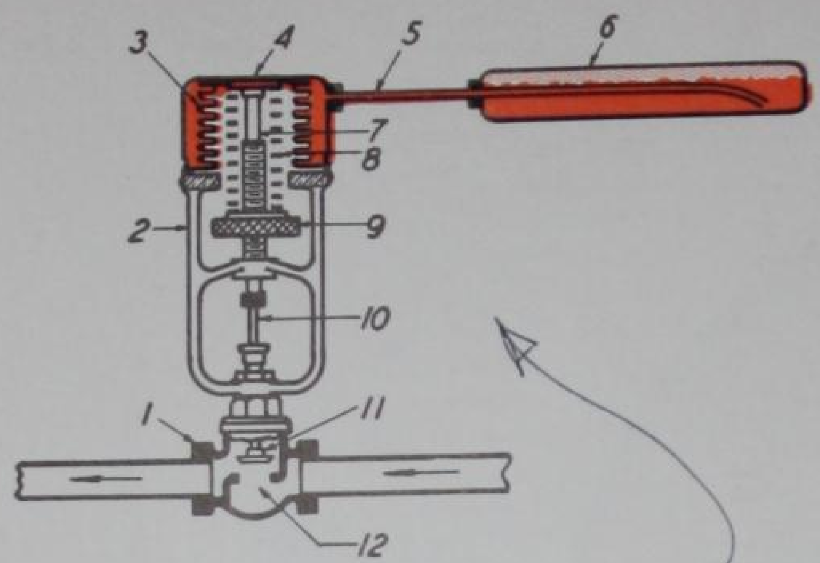
CONDENSED CATALOG "E"

Temperature
Regulators, Etc.
for
Heating and
Ventilating

FULTON Sylphon TRADE MARK FOR TEMPERATURE CONTROL

FULTON SYLPHON DIVISION
Robertshaw-Fulton Controls Co.
KNOXVILLE 4, TENNESSEE

SYLPHON REGULATOR TYPES



VAPOR PRESSURE TYPE

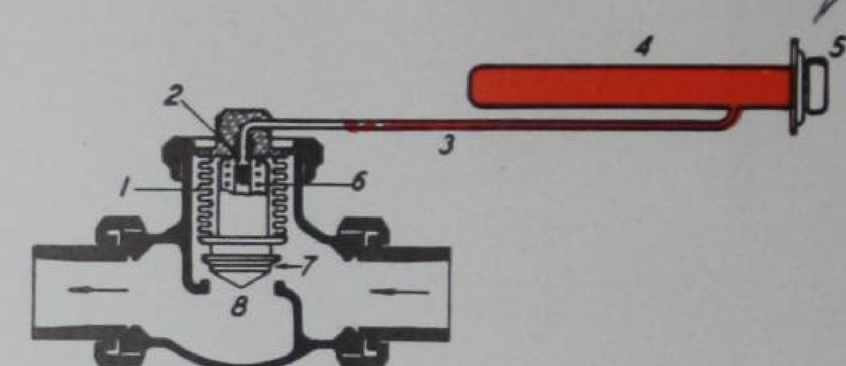
Regulators Nos. 885, 886, 945, 998-A and 999 series described in this catalog are vapor pressure type and are operated by power developed from vaporization of a liquid contained in the bulb. The liquid boils at low temperature and gives off vapor when bulb is subjected to heat, thereby creating pressure within the bulb. Since end of the capillary tube is always below liquid surface in the bulb, the vapor pressure forces liquid out of bulb, through connecting tubing into bellows chamber to move the valve stem in accordance with temperature changes at the bulb.

This familiar type regulator is usable over a wide spread of ranges and for either heating or cooling applications when equipped with proper type valve and bulb. Common applications are: storage water heaters, fuel oil preheaters, brine cooled refrigerators, etc.

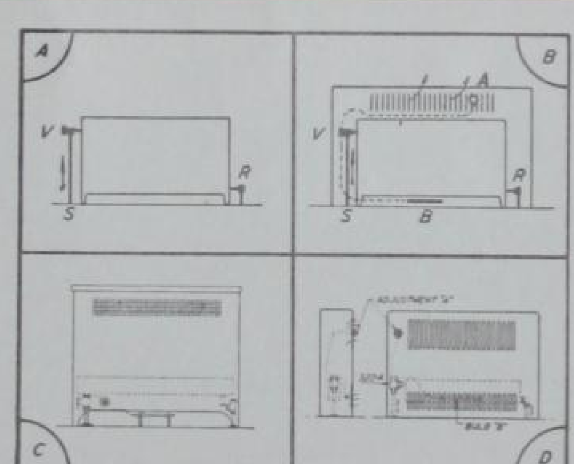
HOT CHAMBER TYPE

Temperature regulators listed in this catalog other than those mentioned at left are "hot chamber type" as illustrated below. Steam surrounds the bellows or hot chamber even when valve is closed—keeping the chamber constantly hot. The bulb is completely filled with a volatile liquid and connecting tubing is partly filled when bulb is cool. When bulb is subjected to heat, this liquid expands and moves into hot chamber where it flashes into vapor. This vapor builds up pressure to move the valve poppet in accordance with temperature changes at the bulb. When temperature at bulb drops, the vapor condenses and cycle of operation is reversed.

The advantages of this type of regulator are: narrow proportional band, dial type adjustment, packless valve, compact construction, etc. Particularly suitable for heating and ventilating control applications. For steam service only.



Typical applications of **MODULATING** *controls*



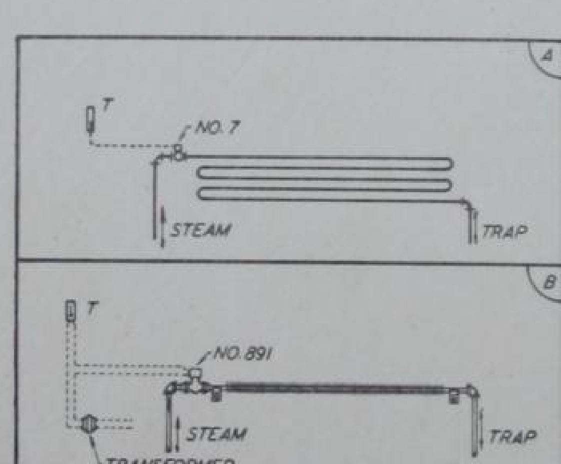
HEATING
(Radiators and Convectors)

(A) No. 885—Automatic radiator valve located on steam inlet to a standing radiator. For two-pipe steam system (under certain conditions suitable for hot water heating system). No. 885 described on page 8.

(B) Shows No. 895 controlling concealed cast iron radiator. For two-pipe steam system only. For description of valves, see page 8.

(C) No. 895—Automatic radiator valve located on steam inlet to a convector.

(D) No. 522-A—Installed on hot water convector. See description of regulator on page 7.



HEATING
(Wall Radiators)

(A) No. 7—Self-operated regulator with adjustable room thermostat "T" controlling steam supply to a wall type radiator. See page 6 for description of regulator.

(B) No. 891—Electric, low-voltage, on-off type regulator controlling steam supply to finned pipe wall radiator. Valve controlled by wall thermostat "T" located at remote point. This type control preferred to modulating type (No. 7, etc.) for long runs of heating surface or wide heating "zone" or where installation of armored tubing of No. 7 would be difficult. See page 8 for description.

Sylphon
TRADE MARK ®

HEATING AND VENTILATING CONTROLS

ON pages 2 to 5, inclusive, are shown some of the most common applications of Fulton Sylphon controls for heating and ventilating systems. These simple drawings and principles depicted will suggest other applications or arrangements to meet specific requirements.

The controls recommended on the application drawings, as well as other products applicable to the heating and ventilating field, are described briefly on the following pages of this condensed catalog. Complete information on any item cataloged will be supplied promptly by our representative in your vicinity and he will gladly assist in the solution of any control problem—his name and address available on request.

Notes on System Design

Careful attention to the following points will contribute much to the success of the control installation:

(a) Good air diffusion without blasts at points of delivery is essential.

(b) Proper thermostat location. Room thermostats should be located at points of good air movement and representative space temperatures. They should not be subjected to "false" heat or cold exposure.

Duct thermostats should be located at point of mean duct temperature and not close to heating coil face.

(c) Coils and fans should be selected and arranged to minimize temperature stratification in ducts and thus avoid false temperatures on discharge control thermostats.

(d) Effective drainage of condensate, which is essential to good temperature control, must be provided.

Other instructions relating to the installation and operation of the regulator are contained in instruction sheet supplied with each regulator.

OTHER ITEMS IN THIS CONDENSED CATALOG

In addition to the controls for heating and ventilating systems, the following products are briefly described in this condensed catalog: Controls for fuel oil heaters, storage water heaters, etc. (regulators Nos. 998-A and 999 series); dryer or duct control (Nos. 945 and 999 series with fin type bulb); pressure regulation (Nos. 991, 992); safety regulators for oil fired boilers, furnaces, etc. (Nos. 955, 955-HK); expansion joints for risers carrying steam or water (Nos. 110-M, 111-M); expansion joint for hot water lines such as used for baseboard radiation, etc. (96066).

For a listing of other Fulton Sylphon products, see page 11.

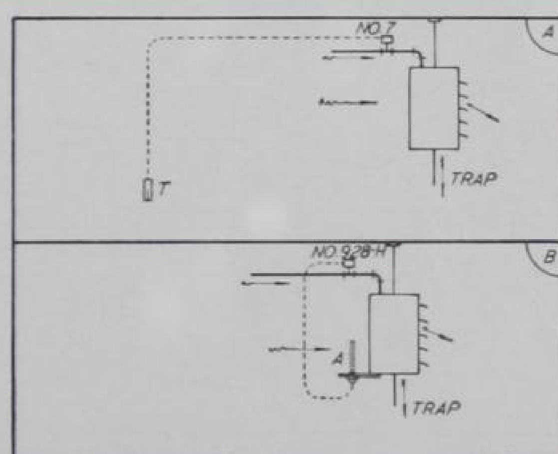
Simple . . . Self-Operated . . . Accurate . . . Easily Installed . . . Long Lasting

HEATING
(Unit Heaters)

(A) No. 7—Self-operated regulator with adjustable room thermostat "T" controlling steam supply to a unit heater. For description of regulator, see page 6.

(B) No. 928-H1—Self-operated regulator controlling steam supply to a unit heater. Adjustable thermostat "A" located behind fan in path of air entering heater. Fan operates continuously to distribute heat. For description of regulator, see page 6.

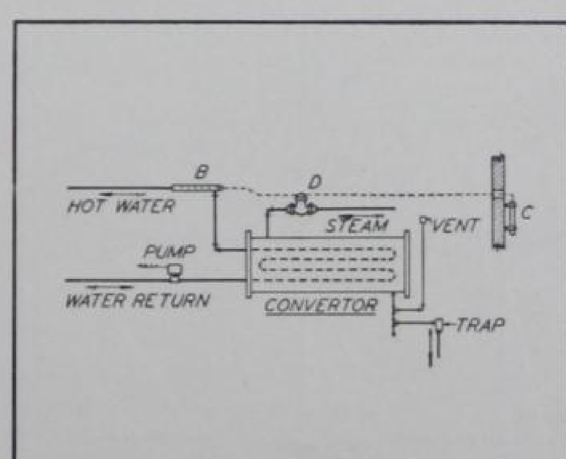
These regulators are modulating (gradual) in action. Where high velocity air stream from heater at low temperature (valve nearly closed) would be objectionable, a strap-on thermostat or other means should be used to stop the fan when steam supply is shut off by the regulator.



HEATING
(Hot Water or Radiant)

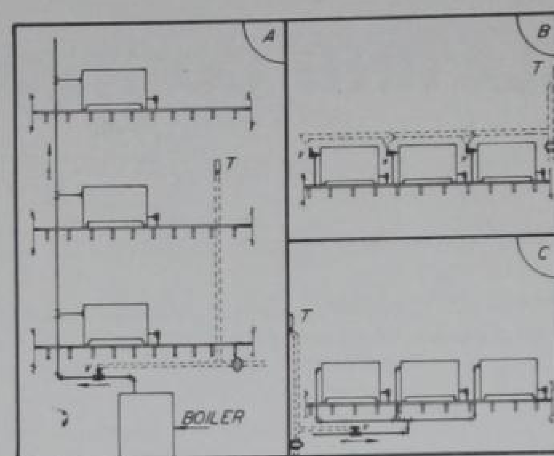
Nos. 928-P1, 928-Q1, 928-S1, 928-T1—Provides control of hot water or radiant panel heating system using a steam convertor for primary heat source. Adjustable liquid control thermostat "B" in heated water leaving convertor. Weather compensating bulb "C" located in outdoor air. Compensated to give rising water control temperatures with falling weather temperatures in accordance with system design characteristics. See description, page 6.

No. 96066 Expansion Joint—Packless joint designed to absorb expansion of radiant heating system piping. See description on page 10.



FULTON Sylphon FOR TEMPERATURE CONTROL

APPLICATIONS

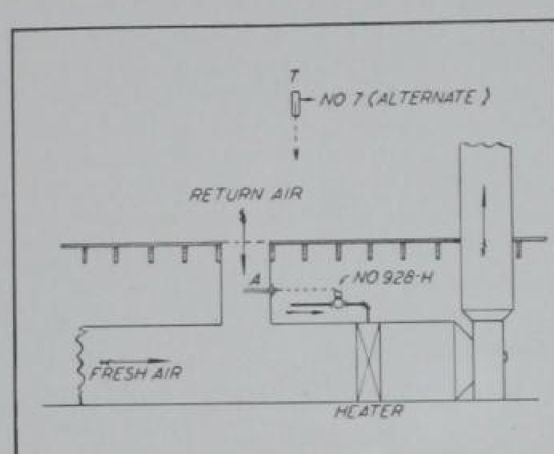


HEATING

(Zone Control)

No. 891—Provides steam supply control to each zone or area having same exposure and heating characteristics. Electric valve on common supply line to the zone and operated by wall thermostat "T" located in controlled space. See drawings "A" and "C."

Drawing "B" shows zone control from a wall thermostat governing a number of radiators individually equipped with No. 891 regulator. For description of regulator, see page 8.

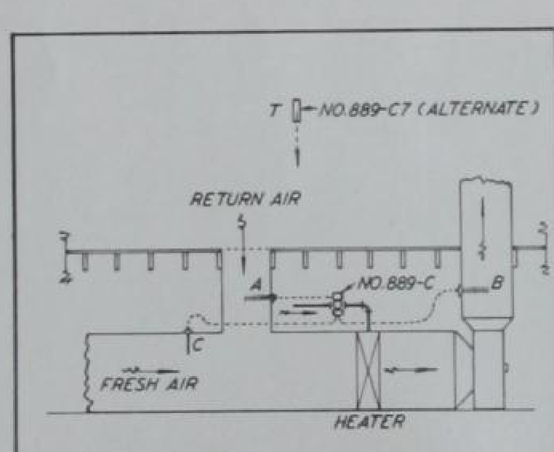


HEATING AND VENTILATING

(Central Fan System. Low % Fresh Air)

No. 928-H1—Maintains space temperature where steam coil in duct system is the primary source of heat and where a small per cent of fresh air is used with recirculation. Adjustable thermostat "A" located in return air. Self-operated, modulating type regulator, described on page 6.

Alternate No. 7—The No. 7 regulator would be used for this application if it is desired to control from a room thermostat "T." For description of No. 7 regulator, see page 6.

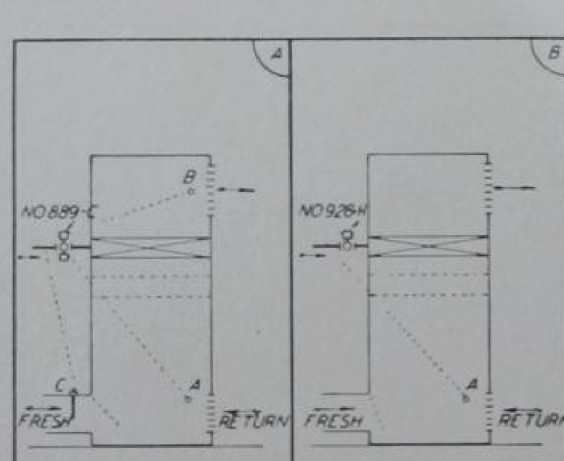


HEATING AND VENTILATING

(Central Fan System. High % Fresh Air)

No. 889-C—Dual valve regulator used to modulate steam supply to heater coil. Main supply port modulated by adjustable thermostat "A." Secondary port controlled by adjustable thermostat "B" and weather compensating bulb "C." Bulb "B" functions to maintain desired "low limit" control in event main control becomes satisfied and closes. "Low limit" control may be provided for constant delivery temperature (load droop compensation) suitable for most systems or for rising discharge control temperatures as weather temperatures fall (rise compensation). See page 7.

Alternate No. 889-C7—Main supply port modulated by adjustable room thermostat "T" located in controlled space. Otherwise, same as No. 889-C application.



HEATING AND VENTILATING

(Unit Conditioners)

(A) No. 889-C—Dual valve regulator used to modulate steam supply to heater coil. Main supply port modulated by adjustable thermostat "A." Secondary port controlled by adjustable thermostat "B" and weather compensating bulb "C." Bulb "B" functions to maintain desired "low limit" control in event main control becomes satisfied and closes. "Low limit" control may be provided for constant delivery temperatures (load droop compensation) suitable for most systems or for rising discharge control temperatures as weather temperatures fall (rise compensation). See page 7.

(B) No. 928-H1—Modulates steam supply to heater. Thermostat "A" responsive to space temperature. For description of regulator, see page 6.

APPLICATIONS

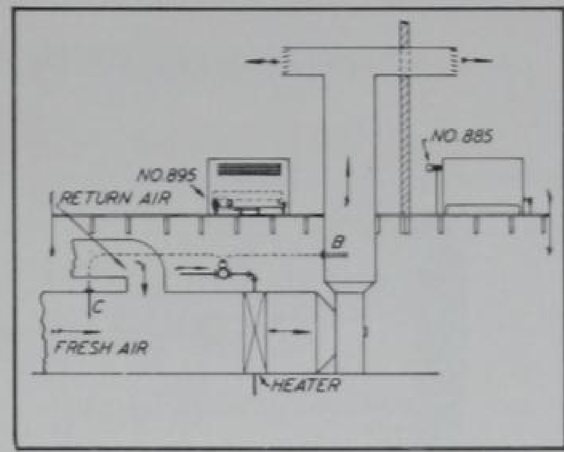
FULTON Sylphon FOR TEMPERATURE CONTROL

HEATING AND VENTILATING

(Split System. High % Fresh Air)

No. 885 or 895—This system involves a duct ventilating supply and radiators, convectors or other similar primary heat sources; and, prevents cold drafts due to high percentage fresh air intake. No. 885 thermostatic radiator valve is here used for standing radiators and No. 895 for convectors, concealed radiators, etc. These valves modulate the steam supply to each heat source to individualize space temperature control. For description of these valves, see page 8.

No. 928-M1—On tempering heater, maintains desired "low limit" discharge temperature by modulating steam supply under control of adjustable thermostat "B" and weather compensating bulb "C." For description of regulator, see page 7.

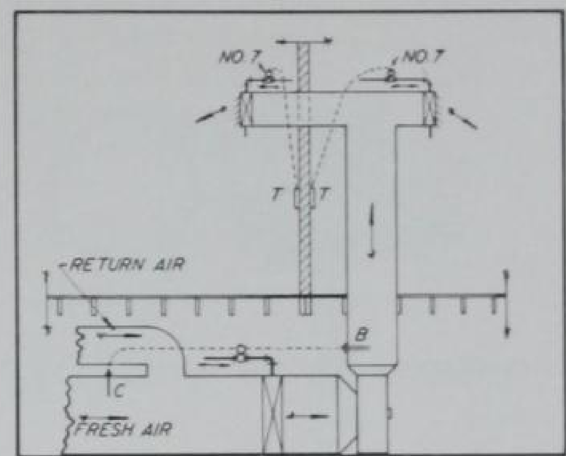


HEATING AND VENTILATING

(Split System. High % Fresh Air)

No. 7—Used on reheaters in individual zones and modulates steam supply to heater coil by means of adjustable thermostat "T" located in controlled space. For description of regulator, see page 6.

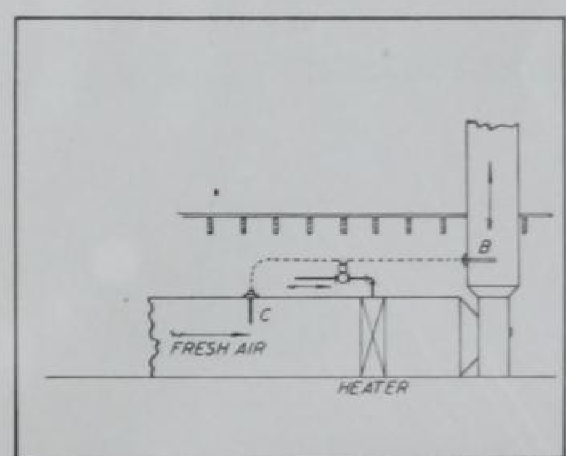
No. 928-M1—On tempering heater, maintains desired "low limit" discharge temperature by modulating steam supply under control of adjustable thermostat "B" and weather compensating bulb "C." "Low limit" control may be provided for constant delivery temperatures (load droop compensation) or for rising discharge control temperatures as weather temperatures fall (rise compensation). For description of regulator, see page 7.



VENTILATING

(Central Fan System. 100% Fresh Air)

No. 928-M1—Modulates steam supply to duct heater coil by means of adjustable thermostat "B" and weather compensating bulb "C." For constant delivery temperatures (required by most systems), the weather compensation is for load droop only. For systems requiring a rising discharge temperature with falling weather temperatures, rising compensation of the instrument is required. For description of regulator, see page 7.

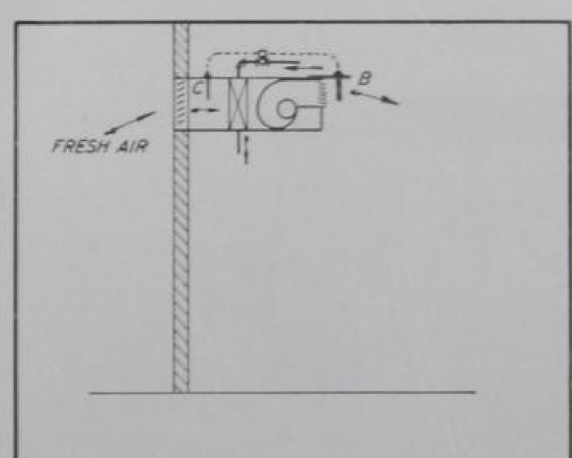


VENTILATING

(Unit Ventilators. 100% Fresh Air)

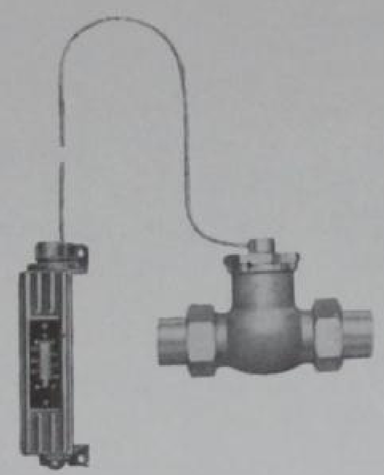
No. 928-M1—Modulates steam supply to heater coil in unit type ventilator used to supply industrial ventilation or make-up for air being exhausted. Control thermostat "B" located in discharged air and compensating bulb in fresh air intake.

For constant delivery temperatures (required by most systems), the weather compensation is for load droop only. For systems requiring a rising discharge temperature with falling weather temperatures, rising compensation of the instrument is required. For description of regulator, see page 7.



FULTON Sylphon FOR TEMPERATURE CONTROL

TEMPERATURE REGULATORS

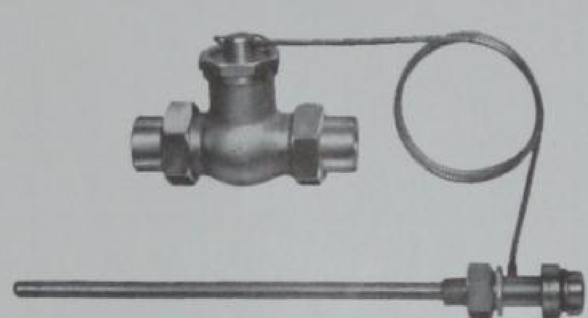


Nos. 7, 7-2, 7-3
Temperature Regulators for Air and Gases

Sturdy, self-powered temperature regulators for controlling steam supply to unit heaters, wall or ceiling type radiators, duct control, etc., where operating temperatures do not exceed 170° F.

These regulators differ principally in capacity and pressure limits. Nos. 7-2 and 7-3 are suitable for steam pressures up to 75 lbs.; No. 7, up to 15 lbs. Packless construction.

Valve sizes: No. 7, ½″ to 4″, inclusive; No. 7-2, ⅜″ to 1½″, inclusive; No. 7-3, 1″ to 1½″, inclusive. Supplied with any specified 20° range between 35° F. minimum and 170° F. maximum. 25-ft. length connecting tubing between thermostat and valve.

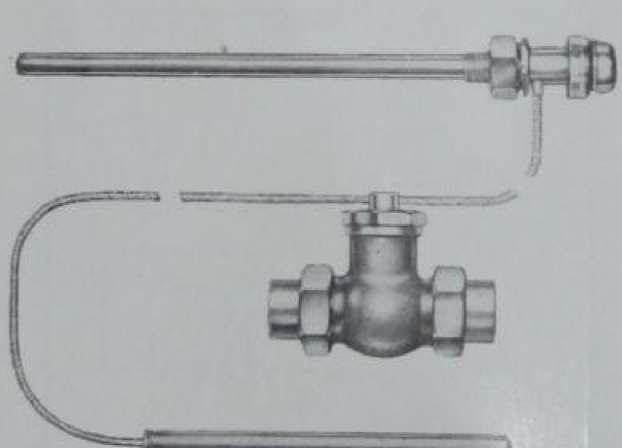


Nos. 928-D1, 928-E1, 928-F1, 928-G1
Temperature Regulators for Liquids

Suitable for low pressure steam control such as hot water storage heaters, etc., where accurate temperature control is essential and where operating temperatures do not exceed 170° F.

These regulators differ principally in capacity and pressure limits. Nos. 928-D1 and 928-E1 are suitable for steam pressures up to 15 psig; Nos. 928-F1, 928-G1, up to 75 psig.

Valve sizes: No. 928-D1, ½″ to 1½″, inclusive; No. 928-E1, 2″ to 4″, inclusive; No. 928-F1, ⅜″ to 1″, inclusive; No. 928-G1, 1″ to 1½″, inclusive. Supplied with any specified 60° temperature range between 35° F. minimum and 170° F. maximum. 10-ft. length tubing between bulb and valve.

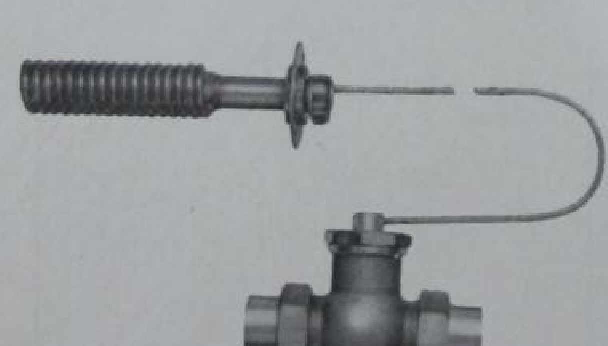


Nos. 928-P1, 928-Q1, 928-S1, 928-T1
Regulators for Space Heating Systems

Outdoor compensated liquid controls for steam-liquid convertors for hot water or liquid space heating systems. Suitable for temperatures up to 170° F.

These regulators differ principally in capacity and pressure limits. Nos. 928-S1 and 928-T1 are suitable for steam pressures up to 75 lbs.; Nos. 928-P1 and 928-Q1, up to 15 lbs. Packless construction.

Valve sizes: 928-P1, ½″ to 1½″, inclusive; 928-Q1, 2″ to 4″, inclusive; 928-S1, ½″ to 1″, inclusive; 928-T1, 1″ to 1½″ inclusive. Adjustable over any specified 60° temperature range between 35° F. minimum and 170° F. maximum. Connecting tubing lengths: adjustable bulb to valve, 10 ft.; compensating bulb to valve, 25 ft.



Nos. 928-H1, 928-J1, 928-K1, 928-L1
Temperature Regulators for Air and Gases

Especially suited to control of air temperature in ducts, drying machines, etc., where temperatures do not exceed 170° F. Bulb constructed of coiled copper tubing. Packless valve; dial-type adjustment; sensitive operation.

These regulators differ principally in capacity and pressure limits. Nos. 928-H1 and 928-J1 are suitable for steam pressures up to 15 psig; Nos. 928-K1, 928-L1, 75 psig.

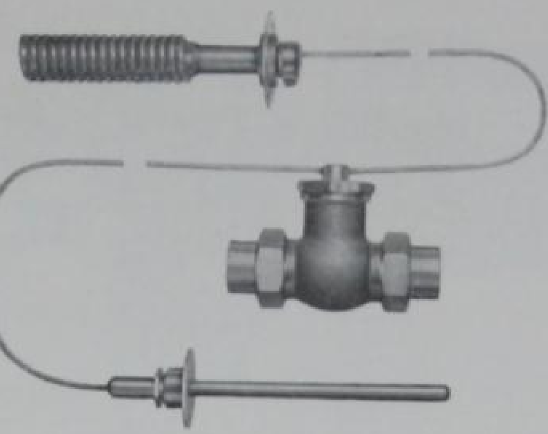
Valve sizes: No. 928-H1, ½″ to 1½″, inclusive; No. 928-J1, 2″ to 4″, inclusive; No. 928-K1, ½″ to 1″, inclusive; No. 928-L1, 1″ to 1½″, inclusive. Supplied with any specified 60° temperature range between 35° F. minimum and 170° F. maximum. 15-ft. length tubing between bulb and valve.

TEMPERATURE REGULATORS

Nos. 928-M1, 928-N1
Temperature Regulators for Air and Gases

Single valve regulator for modulating control of heating and ventilating systems. Main control bulb (with adjustment) is compensated by other bulb shown. Automatically adjusts control bulb to prevent "droop" where a constant discharge temperature is desired or, when specified, provides a "rising characteristic" where a proportionately higher control discharge temperature is desired.

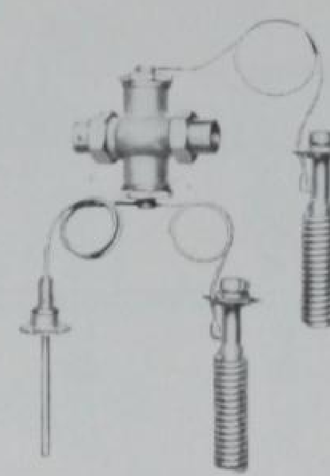
Suitable for steam pressures up to 15 lbs. Packless construction. Sizes ½" to 1½", inclusive, are designated as No. 928-M1, larger sizes as 928-N1. Connecting tube lengths: adjustable bulb to valve, 15 ft.; compensating bulb to valve, 10 ft. Regulator can be supplied with compensating bulb for temperatures down to 0° F. and with control bulb for any 60° range up to 170° F.



No. 889-C
Temperature Regulator for Air and Gases

Modulating, dual function regulator for control of duct heating and ventilating systems. Two independent valves in single body. Upper valve equipped with adjustable control thermostat. Lower valve equipped with adjustable thermostat with compensation which automatically prevents "droop" where constant discharge temperature is desired or, when specified, provides "rising characteristic" when proportionately higher control discharge temperature is desired.

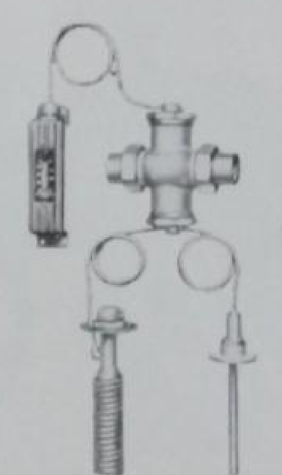
For steam pressures up to 15 lbs. Valve sizes: ¾" to 1½", inclusive. Tube lengths: thermostat to upper valve, 25-ft.; adjustable thermostat to lower valve, 15-ft.; compensating bulb to lower valve, 10-ft. Adjustable over any specified 20° range between 35° F. minimum and 170° F. maximum.



No. 889-C7
Temperature Regulator for Air and Gases

Modulating dual-function regulator for control of duct heating and ventilating systems. Two independent valves in single body. Upper valve governed by a room thermostat. Lower valve equipped with adjustable thermostat with compensation which automatically prevents "droop" where constant discharge temperature is desired or, when specified, provides "rising characteristic" where proportionately higher control discharge temperature is desired.

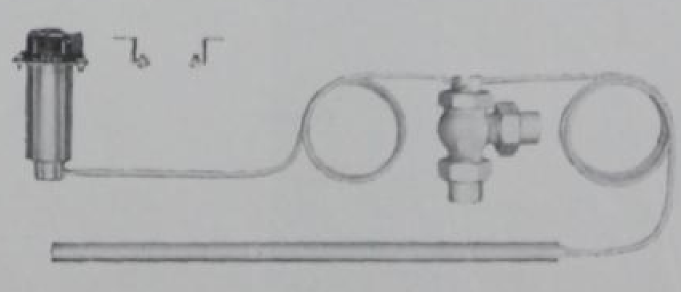
For steam pressures up to 15 lbs. Valve sizes: ¾" to 1½", inclusive. Tube lengths: room thermostat to upper valve, 25-ft.; adjustable thermostat to lower valve, 15-ft.; compensating bulb to lower valve, 10-ft. Room thermostat and lower valve thermostat adjustable over any specified 20° range between 35° F. minimum and 170° F. maximum.



Nos. 522-A1, 522-A2
Regulators for Hot Water Heating Systems

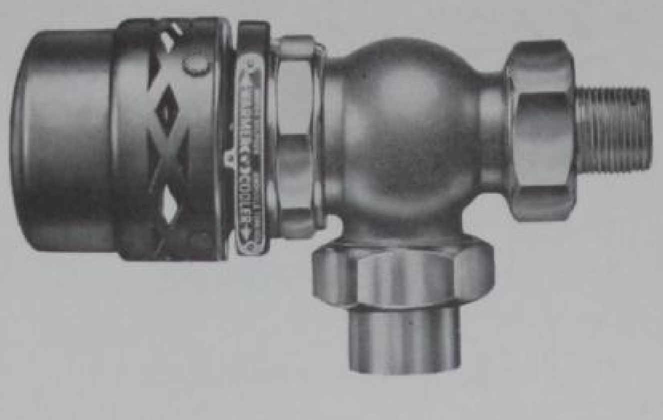
Sensitive, sturdy, self-powered. Provides positive, accurate and reliable control of hot water flow. Used on radiators or convectors to control room temperature. Also applied to convectors where reheating is used in cooling system. On certain types of year-round air conditioning systems, this regulator can be applied to heating surfaces of induction units where such units are used in place of radiators or convectors—serving to control room temperature during both heating and cooling season.

No. 522-A1 has plain tubular bulb (illustrated). No. 522-A2 has finned tubular bulb. ½" packless valve. Standard temperature range, 60°—80° F. Tube lengths: 48".



FULTON Sylphon FOR TEMPERATURE CONTROL

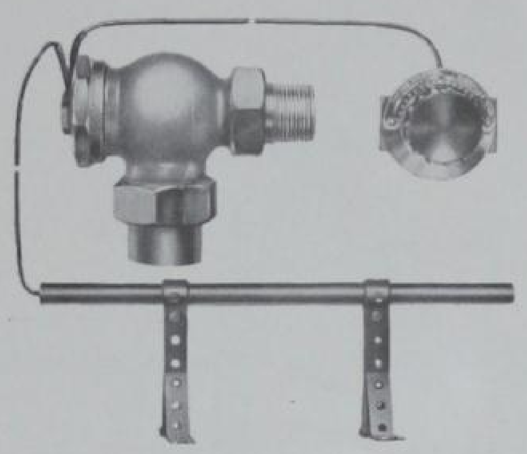
AUTOMATIC RADIATOR VALVES AND TEMPERATURE REGULATORS



Nos. 885, 886
Automatic Radiator Valves

Provides low cost control of room temperature. Self-contained, self-powered. Requires no complicated wiring, piping or auxiliary equipment. Automatically controls steam supply to exposed radiators of a two-pipe steam system where pressures do not exceed 15 lbs. Under certain conditions suitable for hot-water heating systems.

Packless construction. Brass valve body with union ends. Valve sizes: ½″ to 1½″, inclusive. Adjustable range 60°—75° F. Can be set to operate at desired temperature by merely turning head of valve. Adjustment can be locked to prevent tampering. Typical installations shown on pages 2 and 5.

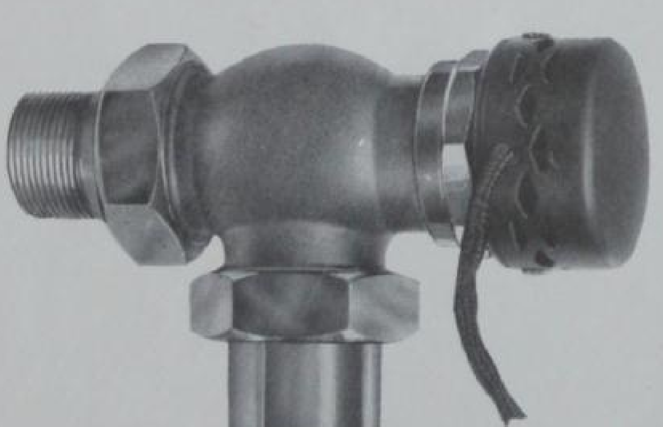


Nos. 895, 896
Automatic Radiator Valves

Suitable for convectors or enclosed radiators and for any two-pipe steam heating system where steam pressure does not exceed 15 lbs. Provides automatic, low-cost control of room temperature. Self-contained, self-powered. No complicated piping, wiring or auxiliary equipment required.

Brass valve body with union ends. Valve sizes: ½″ to 1½″, inclusive. When installed, attractive adjustment knob only exposed part. No. 895 has angle type body, No. 896 has globe type body.

Standard tubing lengths: adjustment to valve, 36″; bulb to valve, 48″. Temperature range 40°—90° F. Knob adjustment. By readjusting factory setting can be set to control over any 50° range between 35° and 130° F.

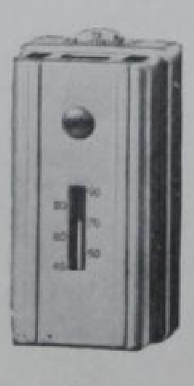


Nos. 890, 891
Electrically Operated Temperature Regulators

Electric, low-voltage (24 volts), on-off type control for one- or two-pipe heating systems where steam supply pressure does not exceed 15 lbs. Used for either exposed or concealed radiators and unit heaters. For control of individual rooms, zones, or entire buildings. Valve operates on 20-25 volts AC or DC. Packless construction. No. 890 available in sizes ½″ to 1½″, inclusive, and has angle type body. No. 891 has globe type body and sizes range from ½″ to 4″ with sizes 2″ and larger having flanged ends.

Valve controlled by a wall type thermostat such as described below. Suitable transformers available.

Preferred to modulating type (No. 7, etc.) for long runs of heating surface or wide heating "zone" which requires full-open or full-closed operation to get proper heat distribution.



Room Thermostats

No. 91766—On-off type thermostat for 20-25 volts AC and suitable for No. 890 and 891 valves in one- or two-pipe heating systems. Contacts close on increase of room temperature. Will control up to ten valves. Temperature range 55°—85° F. Silver lacquer finish.

No. 91839—Has night set-back feature; otherwise, same as No. 91766.

No. 91743—Heat anticipating type. By making and breaking its contacts before the valve can fully open or close, this thermostat will provide a modulating or throttling effect. Not suitable for a one-pipe heating system or service requiring on-off control—for such service use No. 91766.

No. 91835—Has night set-back feature; otherwise, same as No. 91743.

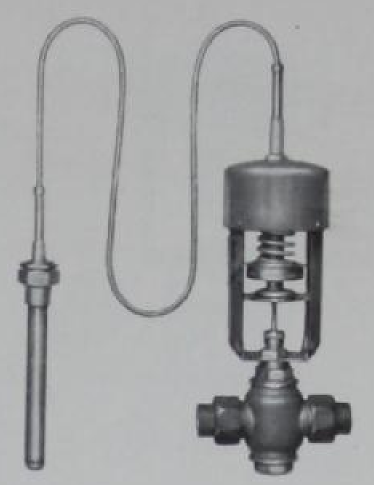
TEMPERATURE REGULATORS AND PRESSURE REGULATORS

FULTON Sylphon FOR TEMPERATURE CONTROL

Nos. 998-A
For Fuel Oil Preheaters, Instantaneous Heaters, etc.

No. 998-A—Recommended where a wide range of temperature adjustment is required. Used for fuel oil preheaters, bottle and can washers, instantaneous type water heaters, petroleum heaters and treaters and for general industrial process applications. "Over-run" temperature feature—protects regulator against damage in event temperature at bulb exceeds range of regulator.

Valve sizes ¼″ to 1½″, inclusive. Valve type: ¼″ to ⅜″, type "C"; ½″, type "A"; ¾″ to 1½″, type "F." Temperature ranges start at 45° F.; end at 480° F. Adjustable over a range of approximately 80° F. Press-formed frame of stainless steel. Bulb for liquids shown; for fin type bulb for air, description of valves, etc., see page 10.



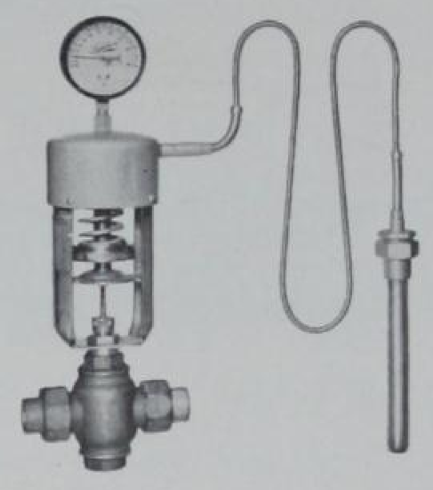
Nos. 999-A, 999-B, 999-T — 930 with Counterweight
For Hot Water Storage Heaters, etc.

No. 999-A—Powerful, sturdily constructed. Press-formed frame of stainless steel. Ideal for industrial processes and other applications requiring accurate, dependable temperature control. "Over-run" temperature feature . . . protects regulator against damage in event temperature at bulb exceeds range of regulator.

Valve sizes ¼″ to 1½″, inclusive. Valve type: ¼″ to ⅜″, type "C"; ½″, type "A"; ¾″ to 1½″, inclusive, type "F". Temperature ranges start at 40° F.; end at 420° F. 40° or 60° range of adjustment. Bulb for liquids shown; see page 10 for bulb for air, description of valves, etc.

No. 999-B—Same as No. 999-A except supplied in sizes 2″ to 4″, inclusive. Type "F" valve. (No. 930 available in sizes 5″ to 10″, inclusive.)

No. 999-T—Same as Nos. 999-A or 999-B except No. 999-T (illustrated) equipped with thermometer.

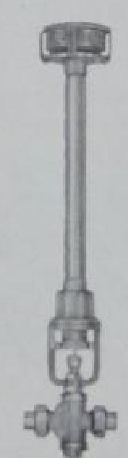


No. 945
Direct Connected Temperature Regulator for Liquids, Air or Gases

No. 945 is used for controlling air temperature in ducts, dryers, etc., or for temperature control of liquids in open tanks, vats, etc.

Valve sizes ¼″ to 1½″, inclusive. Valve type: ¼″ to ⅜″, type "C"; ½″, type "A"; larger sizes, type "F". Temperature ranges start at 50° F.; end at 340° F. 40° range of adjustment.

This regulator is available with temperature ranges starting at minus 50° F. and above for control of refrigerating boxes, water coolers, etc.



Nos. 991, 992, Pressure Regulators

Used as automatic pressure regulator for reducing from high to low pressure or to insure a constant pressure when fluctuating supply pressure is encountered. May also be used as "bellows motor" control valve in pneumatic or hydraulic control systems.

All metal construction. Two-ply seamless metal Sylphon bellows power-element. Stainless steel frame. Valve type: ¼″ to ⅜″, type "C"; ½″, type "A"; larger sizes, type "F".

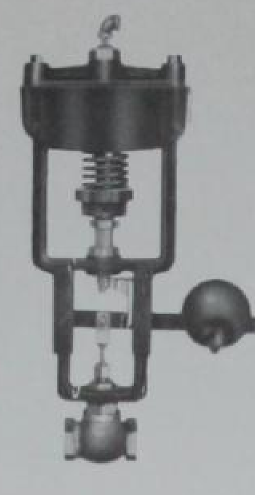
No. 991—Valve sizes ¼″ to 1½″, inclusive. Maximum initial pressure 150 lbs. Reduced pressure 5 to 55 lbs.

No. 992—Valve sizes ¼″ to 4″, inclusive. Maximum initial pressure 250 lbs. Reduced pressure ranges: 2 to 25 lbs.; 3 to 40 lbs.

When equipped with proper valve, can be used as pressure relief valve (Regulators Nos. R-991, R-992) to protect other equipment against excessive pressures by bleeding-off or bypassing medium involved.

FULTON Sylphon FOR TEMPERATURE CONTROL

SAFETY REGULATORS AND EXPANSION JOINTS

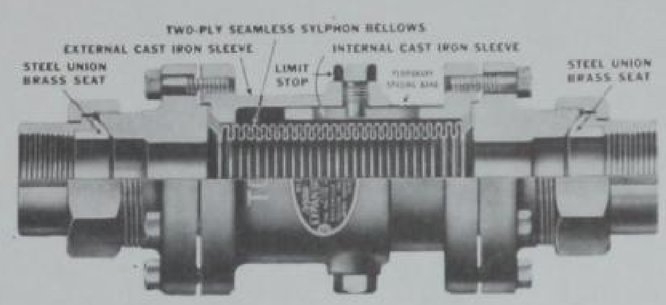


Nos. 955, 955-HK
Safety Regulators for Oil Fired Boilers, Furnaces, etc.

No. 955 is used to protect oil fired boilers or furnaces by automatically shutting off oil supply when atomizing pressure fails or is reduced below required minimum.

Complete information regarding tripping pressures, maximum atomizing pressures, range of adjustment, etc., supplied on request. Sizes ½″ to 2″, type "C" valve; 2½″, type "L" valve.

No. 955-HK is dual purpose regulator—provides same protection as No. 955 and in addition stops flow to burners in event fuel oil supply pressure fails or is reduced below the predetermined minimum.



No. 110-M
Packless Expansion Joint for Steam Lines

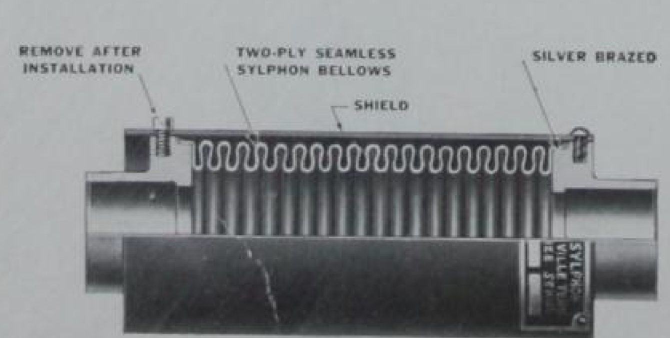
The ideal means for absorbing expansion of heating risers. Packless construction. Eliminates cumbersome loop construction and the costly job of repacking expansion members. May be installed either vertically or horizontally.

Complete, factory assembled unit—ready to be installed. Two-ply seamless Monel Sylphon bellows takes care of any movement of heating riser up to 1¼″. Iron body castings alloyed with nickel and chromium to reduce porosity. Sizes ¾″ to 3″, inclusive. Working pressure limit: ¾″, 1″ and 1¼″—100 lbs.; 1½″—60 lbs.; 2″ and 2½″—50 lbs.; 3″—40 lbs. May be temporarily subjected to test pressures up to 40% above working pressures.

No. 111-M
Packless Expansion Joint for Water Lines

The most satisfactory means for absorbing the expansion of hot water heating system lines, service water lines, etc. A complete factory assembled unit—ready to be installed. Combines packless construction with emergency packing feature. May be installed either vertically or horizontally.

Multi-ply Sylphon bellows absorbs line expansion up to 1¼″ and eliminates leaks and repacking expense. Seamless Monel bellows, steel bolts, other parts brass. Suitable for pressures up to 100 psig.



No. 96066
Packless Expansion Joint for Steam or Hot Water Lines

A simple, compact means for absorbing expansion of "baseboard" radiation, finned convectors, horizontal supply lines, etc. A complete factory assembled unit. Can be easily installed or removed from line.

A two-ply seamless Sylphon bellows absorbs pipe line expansion and prevents leakage. Bellows ends silver brazed to end fittings. Bellows made of phosphor deoxidized copper, other parts made of brass.

Presently made for pipe sizes ¾″, 1″, 1¼″ and 2″. Sizes ¾″, 1″ and 1¼″ have solder type end fittings; 2″ size, screwed ends. Absorbs line expansion up to ½″. Maximum working pressure 40 psig; maximum test pressure, 60 psig.

Sylphon
TRADE MARK ®

PRODUCTS

- ★ Temperature regulators for heating and ventilating
- ★ Temperature regulators for industrial process control
- ★ Internal combustion engine controls
- ★ Packless valves of many types and sizes
- ★ Sylphon bellows assemblies as customers require
- ★ Seals for compressors, fluid drives, etc.
- ★ Motor thermostats for automobiles, etc.
- ★ Pressure regulators and pressure reducing valves
- ★ Safety regulators for oil fired boilers, furnaces, etc.
- ★ Automatic radiator valves
- ★ Expansion joints for steam or water lines
- ★ Hot-cold water mixers
- ★ Vacuum regulators for can closing machines, etc.
- ★ Damper regulators for heating boilers
- ★ Steam-water mixers for industrial service, etc.
- ★ Plastic and metallic seals for shafts, etc.
- ★ Literature describing these products is available on request

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